February 1966

culture

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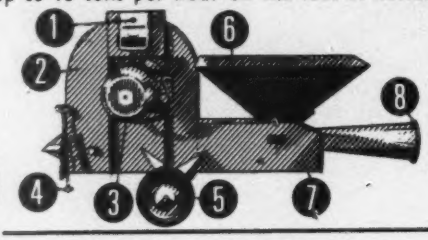

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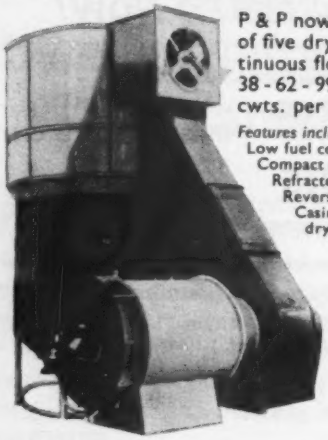

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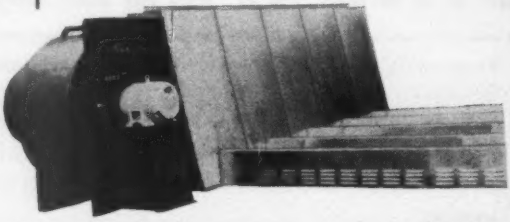

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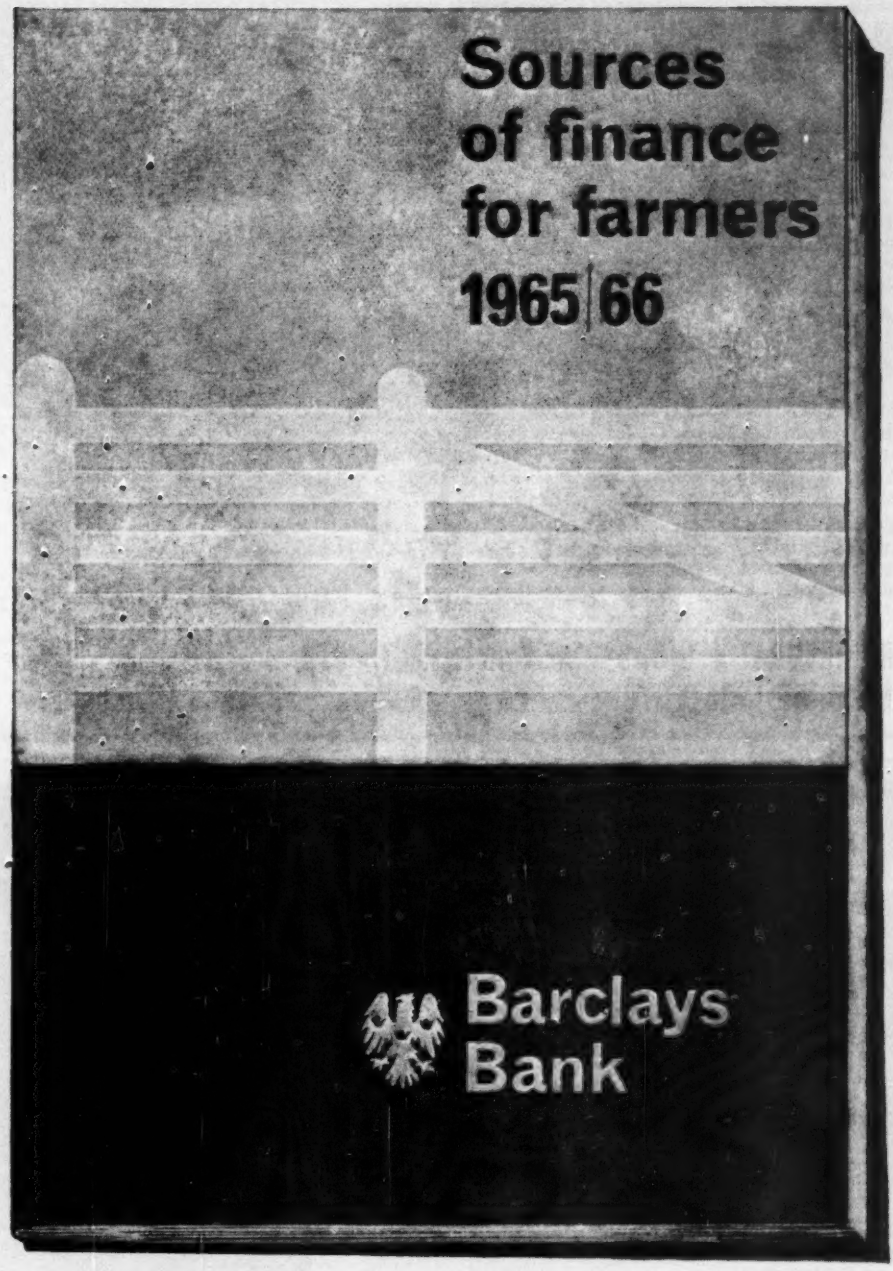

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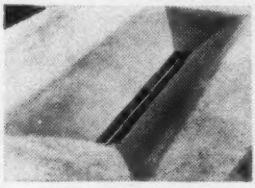

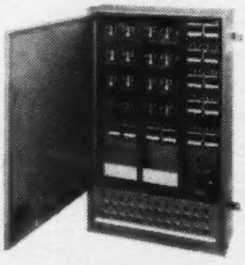

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Agriculture

VOLUME 73 · NUMBER 2 · FEBRUARY 1966

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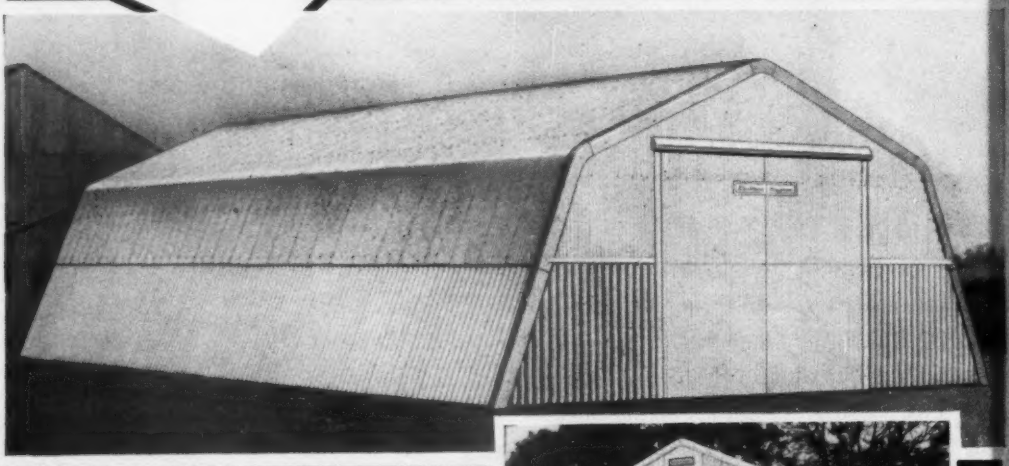

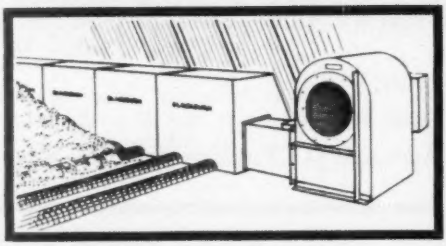

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Taint in Milk

MILK with unpleasant flavours causes much worry and financial loss to producers, particularly those who retail supplies, as nothing is more likely to strain the customer's goodwill. Milk will readily absorb odours from substances like fresh paint, paraffin or silage in either the place of production or processing. Well-ventilated buildings and good management will help overcome this. Certain strong-smelling foodstuffs and weeds will cause taints when ingested by the cow, especially if shortly before milking. Cows in late lactation can sometimes produce a salty-flavoured milk; also physiological disorders may result in abnormal taints.

Badly-maintained and inefficiently-cleansed milking equipment, coupled with poor hygiene, can result in a sour, fishy, malty or fruity flavour caused by bacterial action. Unlike weed and food taints, bacterial taints are seldom noted at milking time as they tend to develop after storage of milk at atmospheric temperature. In recent years a rancid flavour has been noted in some raw milk supplies and has led to consumer complaints. The taint is caused by the action of the enzyme lipase on milk fat once the protective film which surrounds the fat globules has been damaged. It can occur where there is excessive agitation of the milk in pipeline installations followed by low-temperature storage. The severity of this taint has in some cases led to considerable modifications being made to milking plants.

Good husbandry techniques coupled with hygienic milking in well-ventilated premises, with equipment properly installed and maintained in sound condition, will help prevent the occurrence of tainted milk.

G. Tippett

Choosing a Grain Storage System

Claude Culpin

NEW developments in methods of preserving and storing grain have made choice of the most economic storage system a more complex problem than it used to be. Farmers who are faced with the need to plan a new installation or to modify an old one can choose from an array of equipment which varies widely in technical objectives, and in both capital and running costs. Moreover, there is no one way of arriving at realistic estimates of cost which can be applied indiscriminately to all situations. Those who wish to decide on the best system for their individual needs should, above all, avoid taking at face value the advice of those enthusiasts who over-simplify everything, and prescribe a particular system for everybody. There is no sound alternative to looking at the problem from many aspects, both technical and financial, and steadily working through the more important factors involved.

Preservation and storage systems

The main systems of preservation and storage now available may be classified as follows:

(1) Preservation by drying

Types of driers	Main characteristics
(*a*) *Continuous flow*	High-temperature, rapid drying. Positive in action. Generally needs frequent attention during work. Limited capacity can pose management problems.
(*b*) *Batch* (in bulk or in sack)	Medium-temperature, fairly slow drying. Can be left unattended for several hours during drying of each batch.
(*c*) *Bulk* Vertical airflow bins Radial airflow bins Bins with cross ducts On-floor driers	Low temperature, slow drying. Bulk may take many days to dry, especially with vertical airflow bins and floor driers. Drier itself provides storage. Easier handling where bins used.

(2) Preservation at high moisture content

Method	Main characteristics
(*a*) *By exclusion of oxygen*	
In sealed silos	Ideal moisture content 18–24 per cent. Simpler types may have grain removal problems. Suitable for stock feed only.
In unsealed silos	Moisture content may be 30 per cent plus. High rate of use essential. Stock feed only.
In plastic or similar flexible materials	Often much labour required. Mainly suitable for moisture contents up to about 20 per cent, and suitable for stock feed only. Cheap in capital cost but short life.
(*b*) *By chilling*	Mainly suitable for moisture contents up to about 20 per cent. Systems of use not yet finalized, but grain so preserved can be suitable for all normal purposes.

When it is appreciated that several manufacturers offer equipment for each of the purposes listed above, the need for a study of broad principles before getting down to details of proprietary equipment becomes apparent. Some of the main factors concerned in choice of system are:

Purpose for which the grain is required.

Condition in which the grain is normally harvested.

Facilities already available on the farm, and size of the problem.

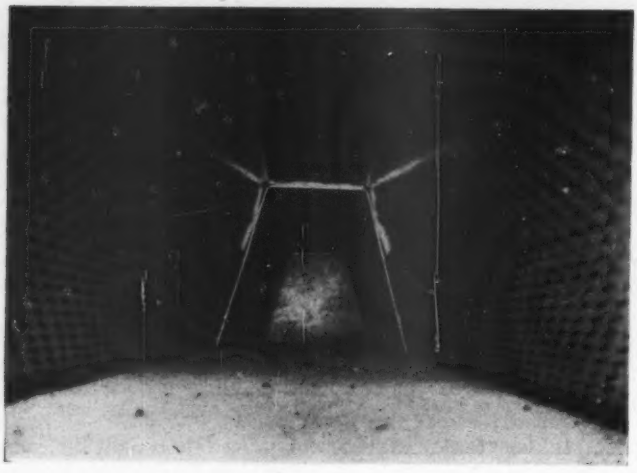
Capital available, and other economic aspects.

These factors are discussed in turn in this article.

Ultimate use of the grain

Most farms which rely for their income mainly on selling grain will need to be able to dry it when necessary. This means that, even though storing a proportion at a high moisture content may be worth considering on a large farm, it will not normally eliminate the need for a drier. Moreover, no farmer who makes it his business to grow and sell grain can afford, in the long term, to avoid providing for medium-term storage of at least a proportion of the crop, to enable him to take advantage of such seasonal price increases as have been offered in recent years to encourage the storage of milling wheat. The extent to which chilling might one day make drying unnecessary is not yet certain; but it will be surprising if grain of over 18 per cent moisture content is ever marketable without penalty. On the other hand, it appears at present that some buyers of grain for all purposes, namely, seed, malting, milling and compounding, are prepared, and indeed keen, to accept well-preserved grain at 18 per cent moisture content in preference to grain which has been dried down to 14 or 15 per cent moisture content. If this trend continues, it could give a boost to chilling as an adjunct to drying. Farmers who have a drier and need either a slightly increased capacity or a means of regulating the need for drying, may find it worth while to provide for holding a limited quantity of grain at high moisture content by adding a small chilling plant.

It may be that, as experience of using high-moisture feed barley increases, there will be an assured market for grain which has been stored in sealed silos. For the present, however, this method of storage cannot be recommended for feed corn intended for sale, since the market is restricted, and not necessarily subject to normal competition.



Inside view of part of a system for drying and storing grain

Grain for home feeding

For grain which is to be fed at home, there is much to be said for airtight storage at high moisture content. This applies particularly to barley destined for cattle feeding, since it rolls particularly well at the recommended moisture content of about 18–24 per cent. Barley intended for pigs or poultry can also be stored in the same way. In this case, where a coarse hammer milling is the normal treatment, it is best not to exceed about 21 per cent moisture content, and 18 per cent is probably better, bearing in mind that 'shelf life' of the ration falls with increasing moisture content. Both chilling and dry storage followed by re-wetting, are alternatives for such feed grain; but neither appears to have any appreciable advantage over airtight storage. The general trend of results to date from feeding trials on grain stored in airtight silos indicates that, within the normal range of moisture contents referred to above, in-silo losses are negligible, and that there is no appreciable difference in feeding value between barley stored wet and barley stored dry. So far as cattle are concerned there is a slight advantage in favour of feeding the barley moist, but on present evidence it does not matter to the stock whether it was effectively stored at high moisture content in a sealed silo or by chilling, or whether it was first dried and then re-wetted. So cost of storage and preparation are the most important factors.

Not much is yet known about high-moisture storage in non-airtight silos. Results to date indicate that this is a practicable system on farms with a very large and regular consumption of barley for cattle feeding; but further trials are needed to evaluate the benefits of an early harvest and ease of grain removal, and possible disadvantages of this type of storage in regard to such factors as in-silo losses.

Condition of grain at harvest

Choice of storage system depends on the condition in which the grain is normally harvested. This in turn depends on the climate, farming methods and combine harvester strength. For example, in the more favoured regions where rainfall is low, weed control almost perfect, and combine harvester strength adequate, there is usually no need to harvest any grain at over about

21 per cent moisture content, and any type of drying system can work well. In fact, in an average season, much of the grain does not need any drying. In the past, some farmers in such regions have preferred to have more than the usual amount of combine harvester capacity rather than a drier; but experience shows that this is not a policy which can be recommended, since it unduly restricts management and marketing possibilities in a wet season.

At the other extreme, on small farms in the north and west, it must be expected that the grain will usually be very damp, and sometimes damaged and rather dirty. Moreover, the harvest may be late in the year, when atmospheric conditions become unfavourable for storage drying. Such circumstances favour medium-temperature batch drying or use of a high-temperature continuous drier, rather than storage drying. Of course, recent developments in airtight storage make it very doubtful whether drying is a sensible method of preservation for such farms, since more and more of the grain is destined for feeding at home.

Adapted or new buildings

There are very few farms where existing facilities do not strongly influence choice of grain storage system; but it is important not to allow existing buildings and equipment to decide long-term policies. Far too often, the existence of a building leads to wrong decisions. While buildings such as Dutch barns can often be effectively used to cover grain drying and storage equipment, attempts to use old buildings often lead to cramped and inefficient layouts, without contributing much more than a roof of rather doubtful value. Now that a wide choice of prefabricated buildings and silos for grain storage is available, making do by use of existing buildings should be questioned. If an old building is used for storing grain in bulk, care must be taken to guard against accidents due to the collapse of unsuitable grain-retaining walls. Often there will be a need to link up with existing food preparation facilities, but here again it may be best to abandon an old two-floor granary and start afresh with a modern single-storey plant, which can be properly designed and located in relation to future needs. All of this has to be carefully studied from the cost aspect. Every change costs money, and the need to keep expenditure within reasonable limits cannot be over-emphasized.

When comparing costs of different methods of grain preservation and storage, running cost is usually less important than capital cost, though differences in running costs can be appreciable where large quantities of grain are involved.

Capital costs

In a comprehensive installation for drying and storage, the drying equipment usually costs less than the facilities for storage, cleaning and handling. Capital costs vary widely for all systems, so any figures given can form only a rough guide as a basis for more detailed study. With these reservations, the following figures indicate typical costs for a limited sample of equipment installed in the years 1963–64. Much lower figures are possible for some types of installations, especially where partly home-constructed plants are housed in existing buildings. It must be borne in mind that better facilities for cleaning and handling are usually provided in the more expensive installations.

An airtight high-moisture grain store with auger feed to cattle in the building on the left

Examples of capital costs of typical grain drying and storage plants installed in 1963-64

Type of drier	Tons per year Dried	Tons per year Stored	Capital cost per ton stored*
			£
Floor-ventilated indoor bins[1]	300	250	16
Floor-ventilated outdoor bins[2]	300	250	12
Radially-ventilated bins[3]	300	250	16
Continuous 1½–2 tons/hr[4]	400	250	20
Continuous 2½–4½ tons/hr[4]	500	300	18
Continuous 5 tons/hr[4]	800	600	16
Continuous 5 tons/hr[5]	800	600	10
In bulk on floor[5]	200	200	9
In bulk on floor	400	400	8
In bulk on floor	800	800	8

*Includes building costs after deduction of grant under Farm Improvement Scheme.

[1]Rectangular galvanized. Cleaner. Bucket elevators. Chain and flight conveyors.
[2]Cylindrical galvanized. Large capacity augers.
[3]Expanded metal. Cleaner. Bucket elevator. Chain and flight conveyors.
[4]Rectangular galvanized. Cleaner. Bucket elevators. Chain and flight conveyors.
[5]On-floor storage. Mobile augers.

Where new buildings and equipment have to be provided, it is usually necessary to allow for annual capital costs at the rate of at least 8 per cent on a building provided by a landlord and about 12 per cent (depreciation and interest) on the capital invested in equipment. Both figures may be appreciably higher in some circumstances. Changes recently announced in the Farm Improvement Scheme ($\frac{1}{4}$ of approved cost on both buildings and a wide range of associated fixed equipment, in place of the old $\frac{1}{3}$ of approved cost of buildings and a limited range of services) will tend to keep down the net cost of installations where a high proportion of the cost is on machinery, e.g., continuous driers with bins. As a general rule, simple storage driers have an advantage over installations which depend on drying machines and conveyors in that (1) a higher proportion of the total cost is invested in buildings or bins with a long life, and (2) the drying equipment for storage drying, consisting of items such as fan, electric motor and main duct, can have

a long life if properly used. In spite of such considerations it may be desirable to write off capital investment quickly, by charging a flat rate of, say, one-eighth of the capital cost. If this is done it will be seen that the fixed annual charges for the installations listed above range from £1 per ton stored for a fairly large floor drier to £2 per ton for some of the more complex plants.

Running costs

Running costs must be added to the 'fixed' costs considered above. They may be almost negligible on some farms in a season such as 1964, but are quite a large item in adverse seasons such as 1965. Removal of 6 per cent of moisture content may be considered average, and in an oil-fired continuous or batch drier this requires about 2½ gallons of diesel oil and about 8 units of electricity for driving the fans, per ton of grain dried. With oil at 1*s.* 4*d.* per gallon and electricity at 1½*d.* per unit, cost per ton is 4*s.* 4*d.* Cleaning and conveying may bring the cost up to about 4*s.* 8*d.* per ton. In an all-electric storage drier the same drying load would normally require about 80 units of electricity per ton, which at 1½*d.* per unit would cost 10*s.* per ton. As before, cleaning and conveying might be reckoned at about an extra 4*d.* On a large installation it is worth while to drive the fan by electricity and to provide heat when required by means of an oil-fired heat exchanger. Running cost is then almost as low as that for the oil-fired drier. In a very favourable year such as 1964, when practically no heat was required with a storage drier, running cost of an all-electric installation can be very low. Conversely, it can be much higher than the average figure given in a cold, late season. In any case, however, it should be noted that running cost seldom equals the 'fixed' annual charges for depreciation and interest on capital.

Many farmers will need to compare the cost of drying and storage with that of preserving the grain at high moisture content in a sealed silo. As with storage of dried grain, the cost of high-moisture storage varies considerably with the scale of the installation, as well as with the type of silo used. Typical capital costs of a medium-priced silo, installed with essential handling equipment, after deduction of grant under the Farm Improvement Scheme, are as follows:

Silo capacity (tons)	Cost of installation
	£
50	650
200	1,600
400	2,500

There is little doubt that such high-moisture silos can have a long life, but in view of the speed with which policy changes can become necessary, it is often advisable to write them off quickly, making an annual charge totalling about one-eighth of the capital cost. This means that capital costs, ranging from about 15*s.* to 30*s.* per ton stored, are rather less than those for drying. Moreover, the higher figure is for only 50 tons stored, and the only running costs are for filling and emptying. So for comparable installations high-moisture sealed storage is likely to be cheaper.

Chilled storage for high-moisture grain is most likely to be competitive in cost where the grain is stored on the floor as in a floor drier. Capital cost of a chilling unit is higher than that of a drying unit; but if the grain can be sold moist, running cost may be lower.

It should be mentioned in conclusion that many small-scale farmers are prepared to put a great deal of scheming and hard work into the construction of home-made storage drying installations, and some of these, housed in existing buildings, can be so cheap as to repay their cost in a single season. At the other end of the scale there are installations of many types which, at a capital cost of well over £20 per ton of grain stored, must take many years to earn their keep. The moral is that capital costs should be checked as thoroughly as possible before beginning to construct a new plant, and if a particular scheme is over-expensive, some of the many alternative methods should be reconsidered.

This article has been contributed by **Claude Culpin, O.B.E., M.A.,** who is Chief Mechanization Adviser in the National Agricultural Advisory Service.

Beef from the Dairy Herd

A Comparison of South Devon and Charolais Crosses

by J. R. Currie and P. Wilkinson

In view of the increasing demand for beef in the United Kingdom as well as throughout the world, there is no possibility of meeting this demand from pure beef breeds alone. In fact, it is estimated that at present less than 25 per cent is being provided from beef herds and, therefore, beef from the dairy herd must be geared to meet the red-beef requirement as economically as possible. This raises very acutely the question of breed and type of bull which, when used on the dairy cow, will produce the most suitable animal to provide a desirable beef carcass, and be most profitable to the farmer.

It was against this background that the Ministry of Agriculture, Fisheries and Food, in June, 1962, asked the Dartington Hall Cattle Breeding Centre to carry out a beef trial including representative cross-bred animals from South Devon and Charolais sires.

In view of the significance of grass in the south-west, and the fact that the two breeds chosen have a high reputation as grazing animals, it was decided to have the trial take place over two pasture seasons. No attempt was made to fatten the animals quickly, irrespective of other economic considerations. Rather, it was planned to have grass play as important a part as circumstances allowed, visualizing that profitable production was the ultimate criterion.

Procedure

Two groups of suitable calves were purchased from local farmers early in 1963. They were matched for age, but otherwise random selected. The ration was determined in co-operation with the N.A.A.S. nutrition chemist at Starcross. The animals, in equal breed proportions, were divided into two groups for winter feeding, but in summer were all run together at pasture.

In addition to keeping accurate records of the feed consumed by each group, individual weighings were made periodically. The bullocks were slaughtered in equal breed numbers in two batches; one at Christmas and the other about three months later. At slaughter, a close inspection was made of each carcass by Ministry graders and by three well-known butchers who represented consumer demand from three areas, Torbay, Plymouth and east Cornwall.

To ensure unbiased judgment, each butcher worked independently and gave points for each part of the carcass according to prescribed standards. The standards were largely devised by J. Walker-Love, Head of the Animal Husbandry Department, West of Scotland Agricultural College, Auchincruive. The carcasses were quartered between the 10th and 11th rib and weighed before inspection. One of each group was minutely examined and measured, especially for eye muscle. The butchers' figures were taken as the index of quality.

Production

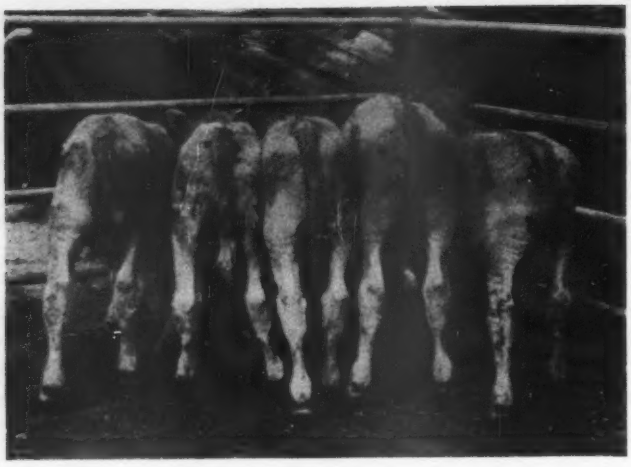
There was, as would be expected, a remarkable similarity in the behaviour of the two breeds. The most apparent difference was during the first eight weeks when the calves were housed in small pens and were getting whole milk; during this period the Charolais were more difficult to feed. When put out to grass the South Devon made slightly greater progress.

First winter period (January—March)

All the calves got a ration of milk for the first eight weeks and later hay and concentrates, calculated to produce a liveweight gain of 1½–2 lb per day. On liveweight gain, both breeds were running almost 'neck and neck'—the South Devon scaled 231 lb and the Charolais 219 lb.

First summer period

To ensure reasonable growth while grazing, the bullocks were given 2 lb supplementary ration. There was only a slight difference in live weight, again in favour of the South Devon, as they made on average 30 lb more live weight.



Charolais/Friesian crosses at 3 months, averaging 230 lb

Second winter period

Both breeds made about the same progress during the winter period. When put out to grass in April, the South Devon scaled 662 lb and the Charolais 640 lb.

Second summer period

Both sets of bullocks did equally well on pasture alone; the South Devon made 510 lb and the Charolais 504 lb.

Finishing period

In September, fourteen of the most forward bullocks (seven of each breed) were selected for slaughter in mid-December. These were given a supplementary ration to give them a reasonable finish. The remaining bullocks were housed in mid-December and were fed to be ready for slaughter in early March. The production figures of both groups were remarkably similar for the two crosses. Statistically, there is no significant difference for either feed consumption or liveweight gain.

As it is notoriously difficult to assess the S.E. value of pasture eaten by bullocks, it was assumed that the animals would, on average, consume the same amount of grass, as they were given an equal opportunity to do so. This is partly confirmed by the similarity in liveweight increase of the two breeds during the period when no concentrates were given.

TABLE 1

Feed Consumption and Liveweight Gain

	Overall liveweight gain (lb per day)	lb Starch Equivalent per lb liveweight gain*
1st Group		
South Devon cross	1·80	2·19
Charolais cross	1·83	2·20
2nd Group		
South Devon cross	1·61	2·70
Charolais cross	1·63	2·70

*No allowance has been made for grass consumed

As would be expected, the consumption figures for the last groups slaughtered were higher than for the first lot; both crosses took 2·7 lb of starch equivalent to produce 1 lb live weight.

The final weighings of the animals on the hoof were very close; the 1st group of both South Devon and Charolais averaged approximately 12 cwt; the 2nd group of South Devons were approximately 12 cwt, and the Charolais approximately 11¾ cwt.

Carcass quality

Several well-known farmers with experience of beef cattle were asked to give their judgment of the live animals. The consensus of opinion was that the Charolais had better hindquarters, but were heavier boned and not so good over the rib. The visual assessment was partly confirmed by both the Ministry and the butchers' figures, but was not so marked as was expected. This is not surprising, as quality is not easy to assess while the animal is alive. Overall, the South Devon were awarded 82·4 per cent and the Charolais 81·9 per cent of the total possible points, made up as in Table 2 (see page 62).

A striking confirmation of the carcass points awarded is that the average price paid for the two crosses was identical, being £101 per head, or 2*s.* 9¼*d.* per lb.

Conclusions

Although the Charolais is a pure beef breed and the South Devon belongs to the dual-purpose category, their performance for crossing on Friesians is remarkably alike. They are both large breeds which carry a lot of flesh. South Devon are slightly the larger, their calves being 8–10 lb heavier. Both breeds do well on grass, and are docile and easily managed.

Three-month-old South Devon/Friesian calves, averaging 240 lb. Both these and the Charolais crosses shown opposite were being fed 6 lb concentrates per day and hay ad lib. before going out to grass. The uniformity in colour of the Charolais in comparison with the South Devon crosses is very striking – although they are very similar in conformation

TABLE 2

Carcass Assessment
Comparison of 30 Charolais and South Devon Crosses

	Charolais (cross)	South Devon (cross)
	%	%
Conformation		
(1) Fleshing (hindquarters)	82	78
(2) Fleshing (forequarters)	79	72
(3) Conformation (overall)	81	79
Finish		
(1) Surface	74	85
(2) Inside	89	87
(3) Kidney and aitch	87	87
(4) Marbling	77	86
Quality		
(1) Colour—meat	81	90
(2) Colour—fat	90	87
(3) Consistency—meat	85	90
(4) Consistency—fat	82	93
TOTAL MARKS	82	82

From the butcher's point of view, which largely determines price, the carcasses are of much the same value. The superiority of the hindquarters of the Charolais is matched by the better finish and quality of the flesh of the South Devon. Apparently, the South Devon is outstanding for the colour of the meat, surface and finish, all of which enables the meat to keep its appearance on the butcher's slab much longer than most other meat, which is an important sales factor.

The joint authors of this article are **John R. Currie, B.Sc., M.Sc., N.D.A., N.D.D.,** who is Hon. Secretary of Dartington Hall Cattle Breeding Centre, Devon, and **Paul Wilkinson, N.D.A.,** who is Manager of the Centre's Progeny Testing Station.

Potato Growing in the Netherlands (2)

F. E. Shotton

It will have been apparent from my previous article that hand planting is not practised in the Netherlands. The mechanical planters are either semi-automatic with men placing seed from trays into cups; or fully-automatic, when men fill the hoppers and the correctors and the machine does the rest. The corrector is essentially a flat sectional dish above each planting shoe. A mechanical sensing device detects cups which do not contain a seed tuber and activates the corrector which drops a seed tuber when needed. Once the hoppers of the machine and the correctors have been filled at the headland, the operator has merely to keep the compartments of the corrector full.

I was told that with a 2-row planter coupled immediately behind the tractor, the tractor driver could attend to his own correctors and so, unaided, plant two rows at a time. With a 3- or 4-row machine the job becomes too much for the tractor driver and there must be a man on the planter, as there must also be if the planter is separated from the tractor by a rotary cultivator. Nevertheless, when we wished to talk to one farmer in the Wieringenmeer Polder who was acting the part of corrector-filler on a 3-row machine, he topped up all three correctors and jumped off to talk to us. The tractor driver not only carried on to the end of the field but turned, topped up again, and set off on the next bout planting three rows unaided. In fact the normal team appeared to be two men, with 3-row machines most common, even though this means opening out tractor wheels to 225 cm (approx. 90 in.) to straddle three rows—for the Dutch very rarely plant behind a tractor wheel.

Seed sizes

This type of automatic planter will not function well with the 1¼–2¼ in. seed normally used in Britain. Dutch practice is to make four size grades: 25–28 mm (1–1·1 in.), 28–35 mm (1·1–1·4 in.), 35–45 mm (1·4–1·75 in.) and 45–55 mm (1·75–2·2 in.). Price per ton falls as average seed size rises, and in 1963 28–35 mm seed cost 35–45 Dutch florins, and 35–45 mm seed cost 20–22 florins per 100 kg of Bintje A stock. The price in florins per 100 kg

One man planting two rows at a time

approximates roughly to £ per ton. Seed is usually, though not always, sprouted and sprouts are kept short and sturdy by starting late and exposing the seed outdoors as soon as the danger of severe frosts is considered to have passed.

The seed is planted at or just below ground level and covered with a small mound of tilth by two small discs. The width of this initial ridge is of the order of 9–12 inches, and the soil from the wheel tracks is not drawn up at this stage. Subsequent cultivations to produce a tilth and build up the ridges are done as quickly as possible, and I understand that the normal situation is that the ridge is completely built before the potatoes emerge. After emergence further soil may be put to the shoulders of the ridge but not on top, and in a normal season a further pass may be made for weed control and to add a little more soil. Such at least was the programme as outlined by one of the pioneers of the new techniques. It would be wrong to imply that there is no variation, and I was not in fact present at the time of the year when inter-row cultivations could go on in the emerging crops.

Use of herbicides

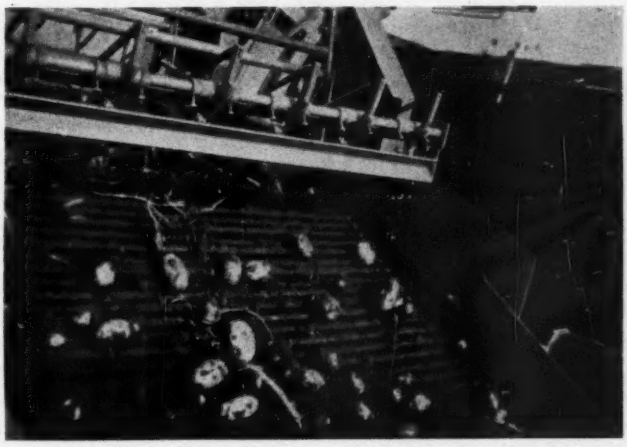
The cleanliness of the crop in September was striking and I can recall seeing only two decidedly dirty fields of potatoes. The use of herbicides in the Netherlands, as in England, is in its infancy. My impression is that, whereas in England we have quite a lot of experimental work but relatively little application, in Holland there is more commercial use, at least in certain districts, but relatively little experimentation. The main material appears to be DNOC which is also widely used in cereals and for potato haulm destruction. The Dutch attitude to herbicides differs from our own. Many Dutch farmers last year had used DNOC to kill off one crop of weeds at a time when the land was too wet to cultivate, but they intended to return subsequently and build up the ridges mechanically.

It would be wrong to give the impression that no potatoes in Holland are harvested by 'stoop labour', but certainly very few appear to be. Where elevator diggers are used they usually deliver direct into sacks either at ground level or on to a following cart. Complete harvesters are however the normal equipment, and are owned either by the farmer himself or possibly shared between him and one other neighbour. The only case of such sharing

I encountered was between two neighbours who, having a combined potato acreage of approximately 40 acres, had this year bought an Amac 2-row harvester costing over £1,000. This particular harvester allows no opportunity for hand picking of clods. More generally there is at least the possibility that clods can be removed by hand, and in rather difficult conditions in early September I found that there was usually at least one man picking clods. On one occasion I saw as many as three people working on a 2-row machine. Obviously, machinery of this type cannot work satisfactorily unless the soil is in good condition and clods are absent. Several factors contribute to this situation: the type of soil, the technique of cultivation and the early-ripening varieties of potatoes (Bintje and Eigenheimer mainly) which permit harvest to take place in September.

The potatoes are delivered into large, usually four-wheeled, trailers holding 4–5 tons. These are emptied either by tipping or by self-emptying devices involving a moving plastic-covered floor and a p.t.o.-driven cross conveyer fitted to the front of the trailer. Either way the potatoes are discharged on to a conveyer, invariably of rubber or of covered metal, and so into the storage cells either on the farm or at the co-operative. At least two conveyers were normally used to get potatoes from the trailer into the cells, and three or four were not uncommon. Such a degree of mechanization is rarely met with on farms of similar size in this country.

Sprout suppression is by the use of IPC/CIPC dust or solution which is either powdered on to the potatoes as they ascend the loading elevator or is blown through the heap in the ventilating air. The dust has the disadvantage of being still apparent when the potatoes are put up for sale, and spirit-based formulations are being developed to avoid this. I saw only two instances, in May, of potatoes being riddled for sale; one was at a co-operative and the other on a merchant's premises. In the former case the Bintje were unloaded from the cell by one man with a fork(!), another man was taking off a few undesirable tubers, two men were taking away the automatically-weighed sacks and a boy was clearing up a little soil and chats. This gang I was told was putting up 35–40 tons in a 9-hour day. The potatoes were going on to the home market. The 35 kg (77 lb) hessian sacks were not tied—a decided saving of time compared with tying up



Potatoes ascending the cleaning web of a 2-row complete harvester on which there is no provision for hand picking of clods

A single-row elevator digger delivering direct into sacks on to a trailer pulled in tandem. The driver has left his tractor and is picking off clods

56 lb paper bags. This rate of throughput required both excellent mechanization and a sound sample of potatoes which needed virtually nothing besides sizing. I cannot say to what extent the equipment I saw was typical of that used for grading on the farms, but quite a lot of grading is done by machinery and gangs sent round by the purchasing co-operatives.

Potato growing in the Netherlands is impressive on account of the care and thought which seems to have been given to every operation and for the small size of the labour gang which is required at any time. There are soils in England on to which one would imagine that this technique could be translated with little or no modification, provided that growers were prepared to acquire the necessary machinery and the knowledge, and also perhaps the patience, needed to operate the technique.

There are other soils in England on which I am altogether less confident that the system could be adopted as it stands. It is, however, so impressive a system that I feel considerable efforts should be made to determine whether it could be employed, or whether modifications could be devised which would permit the same excellent degree of labour economy to be achieved on the more difficult soils in this country.

The problem seems to me to be not merely a matter of machinery, nor a matter of soil and machinery. I have a strong suspicion that we are faced with a certain element of colour-prejudice, and that the farming problem might be more easily solved if the British public could be persuaded to show a greater liking for the earlier-ripening yellow-fleshed varieties of potatoes.

(The author's first article on this subject appeared in last month's issue.)

The National Poultry Costing Scheme

B. St. J. Frost

In these days of increasing costs without relative changes in egg prices, the profitability of the poultry stock is often in doubt until the farmer's accounts are returned by his accountant. Even then the reason for the result, favourable or otherwise, is often obscure, and in all probability the farmer has had to arrange for the flock's replacement many months earlier in the hope that it did contribute to the overall profit of the farm. As a planning aid these accounts fail for two reasons. First, they are available too late, and secondly they are generally compiled to answer the income tax inspector rather than questions of policy and management efficiency.

In an attempt to improve the situation, the N.A.A.S. introduced, three years ago, a Poultry Costing Scheme in which farmers are encouraged to keep records which are analysed and commented upon by the county poultry adviser each month. As with other N.A.A.S. Farm Management Schemes, the results are confidential between farmer and adviser and are not a means of obtaining information for any other purpose.

Because of the wide diversity in methods of egg production, it was found necessary to have three schemes: one designed to include all poultry on the farm and the other two to cater for the rearing and laying stages respectively of the individual flock. Since each scheme has its advantages and disadvantages in recording and subsequent analysis, it is not uncommon for a farmer to use all three at one time. The poultry enterprise scheme will give him the overall financial picture month by month, and the laying and rearing flock schemes will compare such things as breed of bird, different environments, date of hatch, etc., on certain flocks within the enterprise.

Poultry enterprise scheme

This scheme will mainly be of use to a farmer who has a number of flocks, both rearing and laying of different ages, where the allocation of food and labour costs and the separation of egg sales between flocks has proved impracticable or too costly. The basic records required to be kept under this scheme are simple. They comprise a card for each laying house to record daily egg collections and changes in the number of laying birds over a four-week period, and an office card to record weekly food and stock purchases, labour costs and hours worked, and receipts from eggs and culls sold. The quantity of food fed to the laying flock, together with its value,

is kept separate from that fed to the rearing flocks, so that on the monthly progress report the margin of egg sales over feed costs refers only to the laying flock or flocks. This, together with the efficiency factors such as percentage production, percentage mortality, ounces of feed per bird per day, is related to the average number of birds alive during the period. Naturally, care is needed in the interpretation of these figures when more than one flock is being recorded. Food cost per dozen eggs produced, food cost per cwt, and price received per dozen eggs, are also calculated.

After twelve such monthly reports have been sent to the farmer, a final annual report is prepared. This is based on the interim information in the monthly reports, the valuations of livestock at the beginning and end of the year, and any additional costs and receipts that the farmer wishes included. The annual report summarizes the costs and receipts, and draws up a margin between costs and returns which is then expressed as a percentage on both fixed and working capital invested in the enterprise. Should a farmer be thinking of expansion, the margin is also expressed as a percentage return on the new or replacement value of the fixed capital plus working capital. From this information, it is then possible to take decisions on possible changes to improve the efficiency within the poultry enterprise and accurately assess its place in the overall farm structure.

Rearing flock scheme

This scheme is intended to help producers arrive at their costs of rearing a pullet to point of lay. Because the term 'point of lay' is so nebulous, comparisons are worthless unless a standard rearing period is used. We have chosen to record to twenty weeks of age, regardless of when the birds actually produce their first egg. This division between rearing and laying costs makes it possible to produce comparative costings, and thus a critical examination can be made of the merits of home rearing and later, if a laying flock costing is kept, of the effect on physical and financial performance.

The information required is the value and number of chicks bought at day-old or whenever acquired, the quantity and value of food fed to 20 weeks, labour costs, capital involved and mortality. The latter is checked by recording the number of pullets transferred to the laying house. This information is recorded weekly on a single card along with miscellaneous costs as they occur. From this data, a detailed costing is calculated which is based on the number of pullets reared to twenty weeks.

Laying flock scheme

As with the rearing flock, this method of costing depends on the non-addition of birds during the life of the flock, since all calculations are based and expressed on the number of birds housed at twenty weeks of age. If it is intended to add birds, i.e., new birds introduced to replace part of the flock or to fill up spaces due to mortality, the poultry enterprise system of recording should be adopted. Records for the laying flock costing are more detailed and, in many cases, at the end of the year may not prove as accurate as the poultry enterprise costing since, where there are several flocks, certain costs such as labour, electricity and water, often have to be allocated to each flock. As this often entails some guesswork, a certain degree of error will always be present. However, these items are generally

small and insignificant when compared with the more accurate measurement of livestock depreciation, food utilization, egg production grading and value, all of which facts are essential both in the evaluation of the progress of the flock and for comparison with other flocks.

Daily information, such as egg production, mortality, food consumption and value, is recorded on the front of a twenty-eight-day period card, while on the back there is space for egg sales and egg grading. We feel that grading data is only regarded as useful when more than 90 per cent of the eggs are sent to the packing station; anything less invalidates sensible comparisons.

As in the poultry enterprise scheme, the information is processed every twenty-eight days. Although at first glance the laying flock progress record seems complicated, it is in fact quite simple.

The top half of the record shows a breakdown of the efficiency factors and a gross margin of the value of eggs over feed costs, both for the period concerned and the position up to date. The cumulative 'per bird' figures are based on the number of birds originally housed, while the period 'per bird' figures and food consumption are calculated on the average number of birds alive during the period. From this information, weaknesses within the flock may be detected quickly by the advisory officer, discussed with the flock owner and corrected or prevented in subsequent flocks.

The lower half of the record contains the details, sent in by the farmer, from which the efficiency factors are calculated together with a running total of all this information. From this the farmer can tell at a glance the total food fed to date, its value, the proportion and value of eggs sent to the packing station and their grading, and any other facts which he may require to help him in his business.

At the end of the flock's life, further information on capital and miscellaneous costs are collected so that a final report may be made. Policy decisions may then be confidently taken in the knowledge that these figures represent results which can be achieved under conditions of environment and management imposed by the particular farm.

Processing

In the early days of the Scheme, calculations were done in the N.A.A.S. county office under the watchful eye of the poultry adviser. Suspected errors or discrepancies on the forms coming from the farmer were easily checked by a telephone call; this worked well where staff were available but it became evident that it was an expensive operation. With the expansion of the N.A.A.S.'s farm management work and the setting-up of eight regional processing units, responsibility for the calculations were transferred to the N.A.A.S. regional offices. Gradually, as the Scheme became more popular, the work load on the units increased and processing by computer had to be considered. One region therefore undertook a pilot scheme for computer processing and, after a few minor setbacks, a scheme of operation was evolved for the laying flock scheme which is now working satisfactorily.

Further information about the Scheme can be obtained from N.A.A.S. county poultry advisers.

B. St. J. Frost, M.Sc. (Agric.), N.D.A., is a specialist in Poultry Management in the National Agricultural Advisory Service, and is stationed at Reading.

Field of sprouts damaged by dieldrin-resistant cabbage root flies

Insecticide Resistance in Cabbage Root Fly

K. G. Gostick and Patricia M. Baker

THE existence of cabbage root flies, *Erioischia brassicae* (Bouché), resistant to organochlorine insecticides was first reported in 1962 when several accounts were published of damage caused by these flies in Canada and the U.S.A. In 1963 the Ministry of Agriculture, Fisheries and Food were planning to make a survey of the major brassica-growing areas of England and Wales to find out whether resistance was likely to occur there, when an exceptionally serious attack of root fly at Great Rollright, in Oxfordshire, was shown by the National Vegetable Research Station to be due to insecticide resistance. In laboratory tests the Rollright flies were resistant to dieldrin; and dieldrin, aldrin and gamma-BHC were ineffective in the field. This important discovery lent urgency to the proposed survey.

Causes of resistance

Insecticide resistance has been found in many insect species, and is believed to develop where heavy applications of insecticide kill the naturally susceptible flies, leaving only a few which are naturally highly resistant. The latter then breed without hindrance from insecticides or competition from other flies, rapidly multiplying until their numbers reach a level which causes crop losses. The attack at Great Rollright occurred on a farm where excessive amounts of insecticide had been applied for several years, and large residues of aldrin and dieldrin were found in the soil.

Tests for resistance

Before starting the survey, it was first necessary to devise accurate laboratory tests to be applied to the insects, in order to detect resistant flies before crop losses were noticed, and to enable us to distinguish between the damage caused by resistant flies and that attributable to unsatisfactory application of insecticides. It was also necessary to acquire proven susceptible flies for comparison with suspected resistant ones. Both the collection of these flies and the development of the techniques will be described in another report. It is sufficient to say here that the techniques included dipping larvae in insecticide solution, and applying small measured drops of insecticide to adult flies. Resistant larvae developed into resistant adults, and there was a very big difference between the doses required to kill resistant and susceptible insects. As routine tests for detecting resistant larvae or adults, it was therefore possible to use discriminating doses which killed all susceptible individuals but no resistant ones.

Cross resistance

Cultures of dieldrin-resistant and dieldrin-susceptible flies were established in the laboratory. The dieldrin-resistant flies were shown in laboratory tests also to be resistant to aldrin and gamma-BHC. This was not surprising, since aldrin is readily converted to dieldrin both in the soil and in the insect, while gamma-BHC is thought to have a similar mode of action to dieldrin, and cross resistance between these two chemicals has been found in many other insect species.

Cross resistance between dieldrin and aldrin or gamma-BHC has not been tested for at every site where dieldrin resistance has been found, but practical experience in the field indicates that the only safe assumption is that where dieldrin resistance has been proved, the other two chemicals will also be useless.

Cross resistance has been tested for among organophosphorus insecticides including diazinon and chlorfenvinphos but dieldrin-resistant flies were susceptible to these compounds.

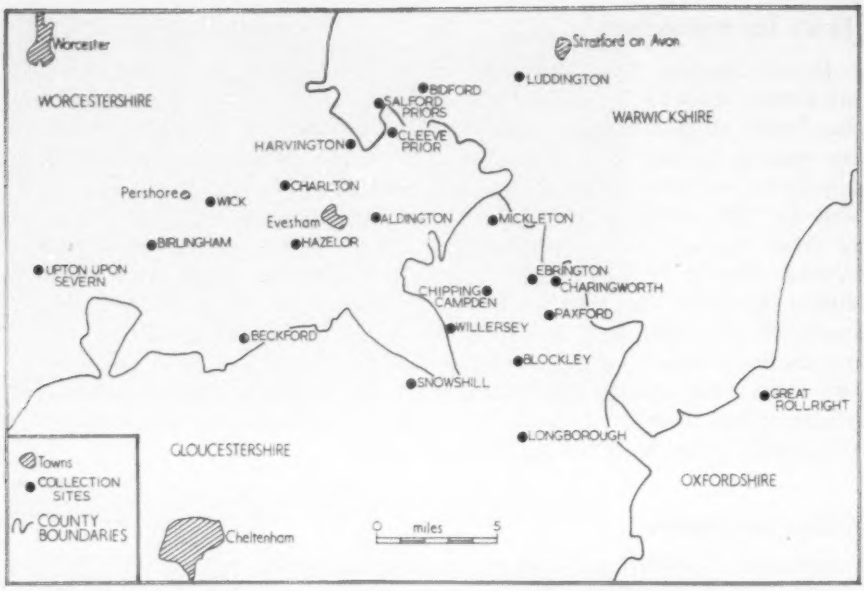
Summer 1964

In June, 1964, serious damage was reported to crops near Chipping Campden, in north Gloucestershire. Flies bred from larvae and pupae collected from sites in this area were treated with a discriminating dose of dieldrin. The numbers of flies tested and the percentages surviving doses which would have killed dieldrin-susceptible flies are given in Table 1.

TABLE 1

Resistance Found—Summer 1964

	Number of flies tested	Per cent resistant
Willersey, Glos	115	97
Chipping Campden, Glos (A)	227	81
Chipping Campden, Glos (B)	49	90
Blockley, Glos.	81	85
Cleeve Prior, Worcs	74	89
Pershore, Worcs	34	6
Luddington, Warwicks	401	36



The discovery of resistant flies at Luddington (Warwickshire) and Pershore (Worcestershire) indicated that resistance might occur in the triangle of land between Luddington, Pershore and Chipping Campden (see map). Outside this area a small percentage of resistant flies was detected at a farm near Baldock, in Hertfordshire. Samples of flies collected in nine other counties in England and Wales failed to show any resistance at this stage.

Winter 1964–65

Overwintering pupae were collected at the sites listed in Table 2. The flies which emerged were each treated with a discriminating dose of dieldrin, and the percentages found to be resistant are given. These tests showed that dieldrin resistance existed in places north of Chipping Campden where damage to crops had not so far occurred. Most of the growers who were found to have dieldrin-resistant flies used diazinon in 1965 and grew good crops, but on the two sites at Charingworth the growers used aldrin and dieldrin and sustained heavy losses.

TABLE 2

Resistance Found—Winter 1964–65

	Number of flies tested	Per cent resistant
Longborough, Glos (A)	74	15
Charingworth, Glos (A)	22	86
Charingworth, Glos (B)	29	93
Ebrington, Glos	40	98
Charlton, Worcs	54	2
Salford Priors, Warwicks	123	89
Baldock, Herts	84	64
Chertsey, Surrey	284	1
Deighton, Yorks	28	0
Reading, Berks	89	0
Shiremoor, Northumberland	77	0
Walton, Radnorshire	60	0
Wenvoe, Glam	402	0

TABLE 3

Resistance Found—Summer 1965

	Larvae tested		Adults tested	
	Number	*Per cent resistant*	*Number*	*Per cent resistant*
Longborough, Glos (A)			14	29
Longborough, Glos (B)	288	49	5	60
Snowshill, Glos (A)			26	81
Snowshill, Glos (B)			40	70
Paxford, Glos	188	93	59	93
Mickleton, Glos	147	36	39	26
Cleeve Prior, Worcs	360	47	27	67
Harvington, Worcs			47	32
Aldington, Worcs	60	20	40	25
Hazelor, Worcs	140	15	42	10
Wick, Worcs (A)	471	86	113	91
Wick, Worcs (B)			34	15
Beckford, Worcs			21	5
Birlingham, Worcs			33	6
Upton-upon-Severn, Worcs	82	5	36	3
Salford Priors, Warwicks	72	8	33	18
Bidford, Warwicks			115	93
Colesden, Beds			13	46
Honeydon, Beds	40	4	10	0
Biggleswade, Beds	271	16	112	44
Willington, Beds	100	55	97	65
Ridgemont, Beds	339	2	41	2
Baldock, Herts			44	32
Peacehaven, Sussex			156	89

TABLE 4

Sites Where Population Still Apparently Susceptible—Summer 1965

	Number of larvae tested	Number of adults tested
Tenbury, north Worcs		79
Bromsgrove, north Worcs	40	23
Ross-on-Wye, Hereford		20
Bath, Som		28
Cawood, Yorks		131
Chertsey, Surrey		51
Kirton, Lincs		311
Quadring Eaudike, Lincs	214	37
Frieston, Lincs	142	53
Old Leake, Lincs (A)	367	39
Old Leake, Lincs (B)		43

Summer 1965

In addition to larvae and pupae, eggs were now collected at many sites. These were bred through to larvae or adults and tested. The sites where resistance was found are listed in Table 3 and those where it was not found in Table 4. At Peacehaven, in addition to the cabbage root flies listed in Table 3, 24 per cent of the maggots found on the roots were bean seed fly (*Delia* spp.). We had no susceptible strain to compare with these flies, but since they are smaller than cabbage root flies, one might expect susceptible individuals to be killed by smaller doses of insecticide than those which killed susceptible cabbage root flies. However, 61 per cent survived the discriminating dose used for cabbage root fly, and since they had also already survived heavy doses of dieldrin in the field, there seems little doubt that these flies have developed resistance to dieldrin. The resistant flies were

identified by Mr. A. C. Pont of the British Museum (N.H.) as *D. cilicrura* Rond., with possibly a few *D. trichodactyla* Rond. Small numbers of these species have been detected at other sites where resistant cabbage root flies have been found, often also apparently resistant.

Conclusions

In 1965 visible damage to crops was not found at all the sites where resistant flies were detected, because their numbers were often small, and the wet summer helped many attacked plants to survive. Experience has shown, however, that where resistant flies have been found at all, their numbers can increase rapidly to levels where losses are apparent. When damage does occur, it is too late to apply alternative control measures against the larvae which are deep down in the soil, and because insecticides have killed parasites and predators which could by themselves have killed the majority of the pest flies, the losses are often much greater than would have occurred before persistent insecticides were used. Flies also spread to surrounding farms. The National Vegetable Research Station has shown that, at Rollright, resistant flies have spread to untreated crops at least three miles away from the original source, while we found that at Mickleton (Table 3) 36 per cent of the flies were resistant in a field where the grower had never applied persistent insecticides. Growers in the areas where resistance has been detected should therefore change to organophosphorus insecticides which will still control the flies. These areas include south Warwickshire, south Worcestershire, north Gloucestershire, north Oxfordshire, Bedfordshire, and the adjacent part of Hertfordshire.

Outside these areas, only two pockets of resistance have been found (Peacehaven and Chertsey), but it must be remembered that in all these tests the percentages of resistant flies are only approximate estimates. Where no resistant flies have been found, some could have been present in the field and missed. The smaller the sample it was possible to collect, the greater the chance of missing some resistant flies. In the tests reported in Tables 2 and 4, where several hundred insects were tested, the chance of missing any resistant flies present was quite small, but where it was only possible to test 20 flies, 10 or 20 per cent of resistant flies could have been present in the field and easily missed. At Chertsey, for example, resistant flies were detected in 1964, but not in the small sample collected in 1965.

Resistant flies may therefore exist in places other than those already known. All those so far detected seem to have originated where heavy applications of insecticidal drenches or sprays have been used against cabbage root fly. Thus, where the use of aldrin, dieldrin or gamma-BHC has been light, resistance is likely to develop slowly if at all; but where there is a history of heavy application of these chemicals, whether on brassicas or on other crops in a rotation, growers would be well advised to consider changing to organophosphorus insecticides for cabbage root fly control.

This work has been made possible by the help given by many members of the N.A.A.S., especially Messrs. K. J. Coghill and R. C. Twyman.

The joint authors of this article are **K. G. Gostick, B.Sc.,** and **Patricia M. Baker, B.Sc.,** of the Ministry's Plant Pathology Laboratory, Harpenden, Herts. Mr. Gostick was previously a member of the Insecticides Department of the Agricultural Research Council's Pest Infestation Laboratory for 12 years. Mrs. Baker was Assistant Entomologist with the Murphy Chemical Co. Ltd. from 1958–62.

Research Spot

Long Ashton Reports

Points from the 1964 Annual Report of Long Ashton Agricultural and Horticultural Research Station

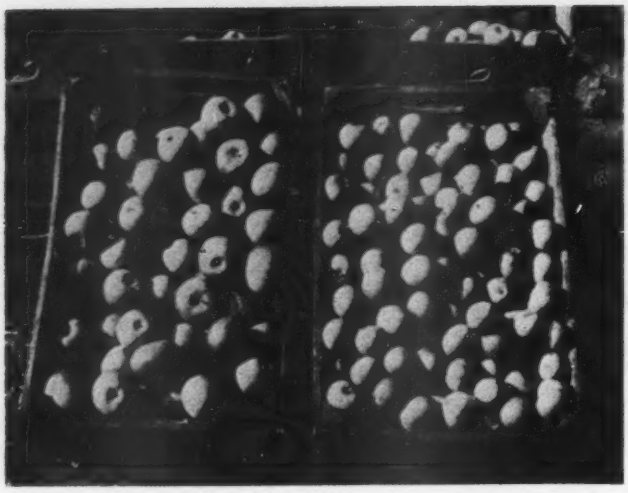
selected by **Sylvia Laverton**

Apples

For the past 20 years scientists at Long Ashton Research Station have been studying the viruses that infect apple trees and seeking methods for preparing healthy propagating material from which new trees can be built up to give more productive orchards. Early in 1964 this work culminated in the release of a large batch of virus-tested bud wood, known to be free from eight of the most common apple viruses*, to the nursery trade. Some 20,000 buds of 13 varieties were distributed, among them Blenheim Orange, Bramley's Seedling, Cox's Orange Pippin, Exeter Cross, Laxton's Superb, Merton Beauty, Merton Worcester, Newton Wonder, Winston and Worcester Pearmain. Buds of further varieties are expected to become available during the next few years. The special scion nursery established at Long Ashton to produce supplies of heat-treated bud wood, run in conjunction with an isolation plot at the Rosewarne Experimental Horticulture Station in Cornwall, should provide enough healthy budding material to cover nurserymen's immediate needs.

To produce healthy trees, healthy rootstocks are as important as healthy scions. Long Ashton's first batch of virus-tested buds was therefore supplied only to purchasers who undertook to work the buds on MM. 104, M. 26, or M. 111 rootstocks known to be free from latent virus infections, or on to seedling crab rootstocks not liable to virus infection. Meanwhile, clones of other rootstocks—M. IX, M. VII, M. II and MM. 109—freed from virus by heat therapy are being multiplied rapidly in collaboration with East Malling Research Station. The two sister research stations last year agreed to pool their top fruit selections, so that from the autumn of 1966 both will be distributing the same selections of all important fruit varieties. This material—the best available—will be identifiable by the letters EMLA followed by a reference number.

*Rubbery Wood, Chat Fruit, Mosaic, Chlorotic Leaf Spot, Spy Epinasty, Dwarf, Scaly Bark and Stem Pitting Viruses.



The Lord Lambourne apples in the box on the left are normal-sized fruit. Those in the right-hand box are from trees infected with Chat Fruit virus

At present little is known about how latent virus infections affect the productive capacity of apple trees. Three trial orchards, the first of a series designed to investigate this subject, have been planted at Long Ashton, at the Luddington Experimental Horticulture Station, and at the Somerset Farm Institute, Cannington.

Heat treatment has also been applied to pears at Long Ashton. The results suggest that virus-tested clones of several dessert and perry varieties can be obtained by 4 weeks' treatment at 96°F. Pears, however, have proved more heat sensitive than apples. They are also more difficult to propagate by tip grafting. A further problem is that the young grafted tips usually fail to make extension growth until the following season, thus delaying re-testing. In a search for more satisfactory indicator hosts for pear viruses promising results have been obtained with a number of *Pyrus* species: *P. sinaica*, *P. bretschneideri*, *P. calleryana*, *P. communis* and the hybrid *P. veitchii*.

Black currants

Work with black currants at Long Ashton is also concerned with the control of reversion virus. The incidence of this virus determines to a large extent the economic life of a black currant plantation. Attempts to eliminate it by the techniques used with apples and pears have shown promise. In these experiments virus-infected black currant plants were grown at 96°F in a hot air cabinet for different periods. Half-inch tips taken from the treated plants were then wedge-grafted on to black currant seedlings. Provided heat treatment was given for at least 20 days, tips obtained in this way from one-year-old bushes of the variety Baldwin which were infected with a severe strain of reversion virus remained free from infection for two years. But virus rapidly re-invaded the parent bushes, though at first they cropped at nearly normal level. The return of the virus was associated with the appearance of a distinct leaf vein patterning. Fruit buds laid down before symptoms were apparent seem capable of producing a good crop the following year, though by then the leaves indicate the presence of infection.

These results emphasize the importance of multiplying special stocks of black currant varieties by means of softwood cuttings taken when virus symptoms would be obvious, instead of using hardwood cuttings taken in the dormant season when reverted shoots are indistinguishable from unaffected ones. Black currants are known to be affected by a number of other viruses in addition to reversion, some of which produce only mild or transient symptoms. The possibility of using heat treatment to prepare healthy stocks of black currants free from all these viruses is now being investigated, using a range of varieties.

Another series of new experiments at Long Ashton is designed to explore the cultural changes required to adapt black currant growing to mechanical harvesting. A long-term study of growth phases is already revealing interesting varietal differences that may have to be considered. In another experiment cuttings of Malvern Cross and Wellington XXX are being planted vertically, at an angle of 45 degrees, and horizontally, at monthly intervals, to determine the best method and time to plant cuttings to achieve rapid establishment. In a third experiment concerned with spacing and its relation with variety, cuttings of nine different varieties have been planted in a logarithmic spacing layout that covers various combinations (both square and rectangular) at distances ranging from 6 inches to 3 feet.

Willows

One of the minor activities for which Long Ashton Research Station is famous is the study of willows. Somerset's basket willow industry is associated with alluvial soils with exceptionally high contents of clay and organic matter. Such soils pose special problems when residual herbicides are used. In 1963 a new commercial willow bed being planted in Wick Moor, near Langport, provided an opportunity to determine the effect of diuron, monuron, atrazine and simazine for weed control. Diuron proved the least effective; a rate of 6 lb per acre was needed to achieve results comparable with the other materials. Monuron was too soluble, being leached into the willow root zone and causing damage. Atrazine at 2 lb

A willow bed three months after treatment with simazine, showing complete control of weeds between the rows

per acre produced little damage and controlled the weeds well, but simazine applied 2–3 days after planting at rates up to 4 lb per acre was judged the best treatment. It prevented the growth of annual weeds and deterred regrowth of perennials.

In established willow beds, success in controlling grasses and annual weeds by means of herbicides encourages a troublesome increase in nettles. Long Ashton's experiments, aimed at finding a suitable herbicides regime to overcome this problem, suggest that amitrole T plus simazine, applied in March when the willows are dormant, will control both nettles and grasses, but it leaves the ground bare. If this is considered undesirable, MCPA may be applied in spring to kill the nettles, and dalapon or paraquat used later to check but not eliminate the ensuing luxuriant grasses.

The 1964 Report of the Long Ashton Research Station can be obtained from the Director, Long Ashton Research Station, Long Ashton, Bristol, price 15*s*.

Wild Oats in Peas

A New Material for their Control

J. M. King

INFESTATIONS of wild oats (*Avena fatua*) in vining peas can cause serious problems for farmers and processors. Not only can they result in yield losses of up to 50 per cent, but they can interfere with the harvesting and throughput of viners to such an extent that the crop is rejected for processing. In dried peas, yield losses and harvesting difficulties increase and in addition the shedding of seeds perpetuates the problem in the field.

Extensive research on the chemical control of this weed in peas has been carried out by the Pea Growing Research Organisation for some years, and as a result a bulletin setting out practical recommendations was issued in 1963. Recommendations for the use of four chemicals, barban, di-allate, propham and TCA, were included, and indications were given as to which should be used according to conditions imposed by soil type, likely wild oat density, the type of pea crop and the date of sowing. Soon after publication the use of di-allate was restricted to sugar beet but the testing of a closely-related chemical 'tri-allate' was begun. This material was found to

be superior to those previously tested and has now been approved under the Agricultural Chemicals Approval Scheme for use with peas.

Trial results

In 1963 replicated trials were carried out with peas to compare tri-allate and di-allate both pre-drilling and post-drilling, propham and TCA pre-drilling, and barban post-emergence. The trials were sited in commercial crops of dried and vining peas, and the results are summarized in the following table. The figures are the means of results at four sites except for the yields, which were taken from one site only.

Treatment	*Rate of application (lb active ingredient per acre)*	*Kill of wild oats* (%)	*Reduction of wild oat panicles* (%)	*Yield as % of untreated control*
Di-allate pre-drilling	1·5	80	63	155
Di-allate post-drilling	1·5	64	55	149
Tri-allate pre-drilling	1·5	87	76	164
Tri-allate post-drilling	1·5	68	68	146
Propham pre-drilling	3·0	72	58	143
TCA pre-drilling	7·0	70	61	143
Barban post-emergence	0·5	—	59	115
Untreated control		—	—	100

It can be seen from the table that the pre-drilling treatment with di-allate and tri-allate gave very satisfactory wild oat control and yield increases, which for both materials were better than those from the post-drilling treatments. Tri-allate is also shown to be slightly more effective than the same rate of di-allate, and while the propham and TCA treatments were inferior to the di-allate and tri-allate pre-drilling, they were slightly better than the post-drilling treatments. Barban, applied post-emergence when the wild oats were at the 1½–2 leaf stage, checked wild oat development as shown by a reduction in weight of wild oat panicles, but did not increase yields as much as the other treatments. The only chemicals to give crop damage were TCA, which caused loss of bloom and leaf distortion at all sites, and barban, which caused slight chlorosis. None of the treatments reduced pea populations.

In the same year two replicated trials were undertaken to test (1) the effects of applying dinoseb-amine, for broad-leaf weed control, following previous applications of wild oat herbicides, and (2) the effects of applying dinoseb-amine following combined applications of pre-drilling and post-emergence wild oat herbicides. The results showed that pre-drilling applications of tri-allate did not increase the susceptibility of the crop to post-emergence dinoseb-amine and that dinoseb-amine could be safely used even if barban had also been applied. Pre-drilling applications of di-allate and propham tended slightly to increase crop susceptibility to dinoseb and barban, while TCA greatly increased the susceptibility. The increase in susceptibility as a result of a post-emergence barban application was slight.

Heavy infestation of wild oats in vining peas. No treatment applied

In 1964 a series of farmer-applied tests were carried out with tri-allate to assess further its efficiency under a range of conditions and to obtain farmer reaction. A group of growers were each supplied with material to treat one acre, and this was applied by the farmer pre-drilling and immediately incorporated into the seedbed. Wild oat counts and assessments carried out during the season showed that, where the material had been applied according to instructions, excellent wild oat control had been achieved and at no site was there crop damage. Farmer reaction was generally favourable, and where control was not altogether satisfactory this could be accounted for by inadequate incorporation or highly-organic soil.

Conclusions

In the trials and farmer-applied tests conducted by the P.G.R.O. tri-allate proved to be an extremely efficient material for the control of wild oats in peas, in which their field of research was conducted, but the Organisation cannot assume responsibility for recommendations made, since the conditions of use of the product are beyond its control and its experience is limited to the actual tests made.

In experiments it was found that when applied at the rate of 1½ lb of active ingredient (3 pints of a 40 per cent product) in not less than 20 gallons of water per acre, and followed by thorough incorporation into the seedbed, tri-allate was capable of controlling 80 per cent or more of germinating wild oats. Experience showed that maximum control was achieved when treatment was applied pre-drilling and that it was safe to drill the crop 2–21 days afterwards. If weather conditions prevented such a treatment being made, it was found that treatment immediately after drilling gave useful but less efficient control, since cultivations were necessarily shallower and incorporation therefore less effective.

For the efficient application of tri-allate it was found that the plough furrow had to be fairly well weathered or lightly cultivated prior to spraying, and that results were unsatisfactory if the soil was unduly wet and sticky or rough and cloddy. In the trials the importance was demonstrated of minimizing loss of chemical through evaporation by thorough incorporation immediately after spraying, and the use of spike or spring-tined harrows,

set to penetrate approximately 3–4 inches, was found to provide uniform mixing of the chemical into the top inch of soil. Two cultivations, the first at right angles to the drilling, produced the most efficient incorporation.

Tri-allate gave good control of germinating wild oats, and it was also noted that it gave useful control of germinating blackgrass; broad-leaved weeds were not affected, but these were safely controlled using the normal rate of post-emergence dinoseb-amine.

The role of tri-allate

The performance of tri-allate in these trials indicated that it was a more efficient material than TCA and in some conditions propham. Certainly on the medium and heavy soils, where propham gave indifferent control and TCA tended to affect the crop adversely, tri-allate was the most satisfactory chemical to use, but on the lighter soils there was still a place for the cheaper propham. Control with propham has been shown to be better on light soils than on heavy soils, and in addition it has given very useful kills of certain broad-leaved weeds, in particular the polygonum species of which knotgrass is one. Thus on light land where there was a knotgrass problem, propham was probably still the most satisfactory treatment. On highly-organic soils the control from pre-drilling materials was generally found to be less efficient than on mineral soils.

Post-emergence treatment with barban was tested in peas, but the effect on the crop in some cases suggested that it would have been preferable to use a pre-drilling treatment and restrict the use of barban to those crops where heavy infestations appeared too late for this to be carried out. The control of wild oats was not always satisfactory, especially where crop competition was poor.

Since none of the chemicals tested was capable of giving total control of wild oats, experience showed that, where extremely heavy infestations were expected, it was an advantage to grow the crop in wide rows to enable tractor hoeing to deal with those which survived chemical treatment.

(Tri-allate is manufactured by Monsanto Chemicals Ltd., and is sold in this country under the trade name Avadex BW.)

This article has been contributed by **J. M. King, M.Sc.**, who is Senior Technical Officer at the Pea Growing Research Organisation's Research Station at Yaxley, Peterborough.

The first few loads going on. Note sand-bags and position of tractor

Vacuum Silage

The Use of Plastic Sheets

C. P. van Zeller

THE vacuum method of silage-making, which was first developed in New Zealand, is now creating widespread interest in Britain.

Vacuum silage is made by sealing the grass between two sheets of thin polythene film and removing air with a vacuum pump—a milk pump is sufficient. The first essential is to make sure that everything likely to tear the bottom sheet has been removed from the site. The bottom sheet should then be spread out on a two-inch layer of lush chopped grass as a further precaution. Wind is always a problem, and a few fertilizer bags half-filled with soil or sand will hold the sheet in position admirably. By folding eighteen inches of the sheet under all the way round, the difficulty of not having enough of the sheet free for subsequent sealing is avoided.

Machinery should not be driven on until a foot or more of chopped material has been dumped and spread. Using the handles instead of the tines of hay forks in the initial stages saves many a hole in the sheets. The stack can be built subsequently by running over with tractors and trailers, using buck-rakes, or from the ground with a front-end loader. If the former machinery is used, there will have been some consolidation in the centre and this will have to be balanced by building up the edges. Failure to do this may result in the edges sloughing off under vacuum. The kits contain a measuring cord so that you can check that the top sheet will still cover the stack and meet the bottom sheet.

As consolidation by rolling is virtually eliminated, heating within the stack will start up fairly quickly. Preservation in the vacuum method relies on air removal, and thus the medium for chemical heat production in the stack is also absent. Heating before sealing should be prevented and the stack should therefore be built in the shortest possible time; two days has been suggested as the limit before sealing the sheets and evacuating the air. If this is insufficient time for building, then rolling will keep the temperature down.

A cubic foot of chopped grass is half air, and a complete vacuum would therefore reduce the heap to half its size. For economy of polythene sheet and ease of handling, the stack should be built up to the maximum height (about 9 feet), air evacuated until it is half size, and then reopened the next day or at a later date for topping up. Reopening the following day usually causes no problems, but it has been reported from New Zealand that, where there have been failures for no obvious reasons, the additional material had a very high moisture content. There should therefore be no undue quantity of water brought in during the early stages of fermentation, either by rain falling directly on the exposed stack or with very wet and lush material. A delay of at least two days has been advocated as the minimum time lapse, but this has yet to be substantiated.

Covering and sealing

The stack hose (for pumping out the air) should be put in place before spreading the top sheet and should be covered with grass. Spreading the top sheet can be a tricky operation in even a moderate wind, but with care the hazards can be reduced. The sheet should be kept folded for as long as possible, and the first move is to unroll it lengthwise on top of the stack along the windward side. The edge should then be slid down the side and attached to the bottom sheet, beginning at one corner and progressing along the length as far as the next corner. The remainder may then be unfolded by gripping the other edge (the sheet should be gripped in handfuls, not just one thickness, or the fingers may tear it) and sliding the sheet across the stack and down the other side. It should be pulled down and the sealing tubes attached as near the stack as possible with all the surplus polythene on the outside of the seal. This cuts down the quantity which could flap in the wind. A fair number of bags of soil, or motor car tyres, are necessary to keep the sheet down, but even so there may be sufficient movement to cause stalky grass to puncture it after the vacuum has been released by the production of carbon dioxide. A stack net would be more suitable where very windy conditions are experienced.

Applying the vacuum

A standard milking machine vacuum pump is adequate for evacuating air from the stack and a 100-ton stack is reduced to about half its size in about two hours. It is as well to have a water trap between the stack and the pump. An old churn, provided it can be made airtight, serves the purpose adequately. A sight glass can be fitted to the side, and a vacuum gauge and adjustable relief valve on the top. The valve enables the farmer to predetermine the vacuum he wants, so that he need not remain at the site to switch off immediately. Vacuum pump units are usually made up and mounted on a frame to fit the tractor linkage and are p.t.o. driven.

Completed stack protected by one inch of soil on top and six inches round bottom

A vacuum up to 18 inches of mercury is desirable because the higher it is the greater the consolidation and reduction in size of the stack. But under conditions of high moisture content, only 6 or 8 inches may be reached before water is seen to flow into the trap. This pressure will be enough for the purpose of fermentation, but the quantity of material that can be enclosed in a given sheet size will be rather restricted.

If there is not an obvious and increasing pressure on the top and sides, once the surplus air has been removed, then there must be a leak somewhere. The pump should be turned off at once and all holes mended—the in-rushing air can be clearly heard. If the leak happens to be at the bottom, nothing can be done short of removing all the grass, mending the tear and starting all over again. In many such cases removing the grass will be too much work and in all probability the seal will be good enough to exclude air and ensure good-quality silage. Under these conditions some of the advantage of extreme consolidation will be forfeited and it will not be possible to put in the maximum quantity.

The next day (following pumping out) the polythene bag is usually found blown up by carbon dioxide which has been produced by the plant material. This gas is itself a preserving agent and should not be pumped out. If left untouched, the gas gradually disperses and the top sheet comes back into contact with the silage again. Should it be feared that the top sheet may split, then it would be wise to open the seal and allow some of the gas to escape.

There may also be trouble with effluent collecting at the lowest point within the bag; this should be allowed to flow out. There have been cases where the seal has burst open or the sheet has split due to the weight of effluent. A permanent drain pipe can be inserted through the bottom sheet, taped into position and fitted with a cork. This may be made automatic by drilling holes in the under side of the pipe and covering with a piece of motor-car tube held in place above the holes by an elastic band. This would act like a flap valve and release effluent when the pressure builds up. Alternatively, the seal can be opened as necessary.

After the final material has been added to the stack and the air pumped out, the polythene must be protected from wind and frost damage during

the storage period. An inch of soil or sand, a stack net, spreading two or three loads of chopped, lush grass, or enough old motor-car tyres or polythene bags half-filled with soil are the possibilities. The first is the most efficient and such a small quantity is easily removed with the hands. It is also a good idea to spill soil or sand down the sides until there are six inches or so all the way round the bottom. This not only tightens up the sheet all the way round, but protects the seal as well.

Labour problems

The speed of filling is clearly a controlling factor in making the best possible quality silage under this method. The problem is usually greatest on the small dairy farm where high-quality winter fodder is most needed. Making vacuum silage is one operation where machinery syndicates and neighbour co-operation are of real benefit, as weather conditions are of less importance than with haymaking. If contractors are available, their employment would be an alternative. A very large proportion of the silage in New Zealand is made by contract and 100 tons a day into the silo is not unusual.

When machinery and labour pooling is under consideration, the resultant acreage to be dealt with may warrant the purchase of a full chop harvester and a blower. This would simplify filling and also allow for wilting. Not only does wilting reduce the weight of water carried into the stack—an increase to 40 per cent dry matter would halve it—but there is no effluent at all.

Bigger farms may have both labour and machinery to handle 100 tons a day, but when 400 or more tons of silage are the aim, speed of filling once again becomes a problem. There can be no overall answer to these problems and while several 150- or 200-ton stacks may suit one farm this would not be the case on another. Because of the watertight properties of sealed, polythene-covered stacks it might be worth while for some farmers to consider converting their present covered silos to house more stock and making all their silage in the vacuum method.

Pump unit, consisting of two redundant milk line pumps and churn, mounted on frame. Vacuum gauge and release valve can be seen on churn

Feeding at the face of the stack

As with all silage, there will be a certain amount of rotting or oxidizing on the exposed feeding face if silage is not removed at least every two or three days. There will not be a layer of self-sealed silage on top of the stack, and so air should not be allowed to penetrate the length of the silo between the top sheet and the silage. A tourniquet of wire threaded through a polythene pipe, or a nylon rope tied every ten feet or so, will prevent this. The tourniquet can be pegged down either side of the stack or put in position before the bottom sheet is spread. An alternative is a line of old motor-car tyres along the edge of the rolled back top sheet; although not quite so effective, this method is reasonably good and is the most suitable where self-feeding is practised.

(A previous article by this author entitled *Vacuum Compression Silage* appeared in the May, 1965, issue of *Agriculture*)

The author of this article, **C. P. van Zeller, M.A. (Oxon.)**, is a N.A.A.S. district advisory officer in Warwickshire. He was formerly an advisory officer in the New Zealand Department of Agriculture.

The Ministry's Publications

Since the list published in the January, 1966, issue of *Agriculture* (p. 40) the following publications have been issued.

ADVISORY LEAFLETS

(*Price 4d. each—by post 7d.*)

No. 39. Fowl Typhoid (Revised)

No. 164. Raspberry Beetle (Revised)

No. 541. Tomato Damping-off and Foot Rot (New)

MECHANIZATION LEAFLETS

No. 2. Field Crop Sprayers (New) 2*s.* (by post 2*s.* 3*d.*)

No. 3. Pumps and Pipework for Heating Systems (New) 1*s.* (by post 1*s.* 3*d.*)

No. 6. Bulk Grain Driers (New) 1*s.* 6*d.* (by post 1*s.* 9*d.*)

No. 7. Units Drills for Root and Vegetable Seeds (New) 1*s.* (by post 1*s.* 3*d.*)

No. 8. Farmyard Manure Handling (New) 1*s.* (by post 1*s.* 3*d.*)

FREE ISSUES

STL No. 47. Business Records—Office Organization (New)

STL No. 48. Business Records—Keeping Financial Records (New)

STL No. 49. Business Records—Feeding Record (New)

The priced publications listed above are obtainable from Government Bookshops (addresses on p. 98), or through any bookseller. Unpriced items are obtainable only from the Ministry (Publications), Tolcarne Drive, Pinner, Middlesex.

37. North Oxfordshire

L. E. Edney

NORTH OXFORDSHIRE is Heythrop country, undulating and well wooded, with an average rainfall of 28 inches. The district extends from Woodstock and Burford in the south, to the Warwickshire and Northamptonshire borders, including Chipping Norton in the north-west and Banbury in the north. To the south-west, the area stretches to the Cotswolds. Here the farmsteads and walls are mostly built of Cotswold stone. The limestone 'brash' soils were traditionally farmed with corn and folded sheep, mostly in large farms.

North of a line from Chipping Norton through Heythrop to Middle Aston, the scenery changes and the oolitic limestone soils of the south-west give way to those of the Lias. The buildings take on the colours of the weathered ironstone mined in the area. The average size of the farms is smaller and the farming becomes rather mixed, with less arable and more cattle rearing, fattening and some dairying.

The Lias area is a plateau intersected by streams flowing eastwards to the river Cherwell and then south along the eastern boundary to join the Thames at Oxford. The higher and fairly level land at the top of the plateau is derived from the Upper and Middle Lias. These form a deep reddish-brown soil, which is loamy, free-working and very productive. In the valleys, the heavy Lower Lias clays come nearer the surface, causing drainage problems. Much of the remaining permanent pasture in the area is in deep ridge and furrow. Drainage, levelling and hedge removal are often necessary to prepare the land for cultivation. At Wroxton St. Mary, large areas are being reconditioned following shallow mining by the Ironstone Company. The soil is replaced and then conditioned for arable cultivation. Fields are fenced-off in large blocks, shelter-belts are planted and, if necessary, pioneer crops are grown. The land is usually alkaline after reclamation.

A feature of North Oxfordshire is the number of large estates and owner-occupied farms of 500–1,000 acres or more. Although the trend is towards larger and fewer enterprises, some pioneer farmers have incorporated intensive methods, tower storage and automatic feeding for beef, similar methods for cows, irrigation for intensive arable crops and grass for dairy cows.

Dairying is concentrated around Banbury and to the south. The large herds are mostly Friesians, on self-fed silage in winter and milked in herringbone parlours. New dairy premises are mostly of the yard-and-parlour type to house a minimum of 50–60 cows. In the limestone area to the west, a few

large herds of 90–100 cows have been introduced to replace the sheep on the traditional corn and sheep farms. The Channel Island herds are mostly in smaller units, but there are some large herds of up to 80 or more around Chipping Norton concentrating on seasonal cream production.

Most of the large herds of suckling beef cattle are grazed on parkland. The cattle are Herefords, Hereford – Shorthorn crosses, Devons, Angus and Blue Greys. The cows are calved early with the object of fattening off the weaned calves as barley beef. On the general farms a high proportion of the barley beef comes from Hereford – Friesian crosses, although there is still considerable trade in Irish and other older cattle for yarding and fattening on pasture.

On the sheep farms there are a number of Clun flocks and a few noted flocks of Oxford Downs for ram breeding; otherwise the ewes are mostly cross-breds from the north or Wales.

There are some pedigree herds of pigs, and a regular Monday sale of breeding stock is held at Banbury. Outdoor pig rearing in large units is very successful on the lighter soils. Few, if any, are left of the Oxfordshire breed of pigs.

Poultry is important on many farms. Most of the eggs are produced in large intensive units and marketed through local egg-packing stations. Broilers, turkeys and some table-rabbits are also fattened intensively, and there are hatcheries for broilers, turkeys, peacocks, guinea fowls, pheasants and other game.

Cereal growing has created a demand for grain storage and drying. On the large corn and sheep farms the trends are towards more wheat and barley with less grass and less stock. Beans, oats and herbage seed are being introduced as 'break' crops.

On the Lias soils towards Banbury, similar systems are practised and a considerable acreage of herbage seed is grown, based on the new strains of ryegrass. Much of the grassland has recently been ploughed out for arable cropping. The wet, unploughable valley pastures are conveniently dealt with by rotavating and direct reseeding. Chemicals are also used for treating pastures and weed grasses on arable land.

Potatoes are widely grown, with some sugar beet and 200–300 acres of sprouts in the Great Rollright area. There is little horticultural production.

The farmers have clubs, co-operatives, buying groups and associations for organizing competitions. Although there is a demand for labour by local industries, a high standard of cultivation and husbandry is maintained on the farms.

The area is well served by markets and merchants, and research and demonstration farms run by various firms cover the whole range of crop and livestock production. The Agricultural Education Department is attached to the North Oxfordshire Technical College, Banbury.

Banbury has one of the largest fatstock markets in Europe, with an annual turnover of half a million head of cattle, dairy cows, sheep and pigs. There is also an A.I. centre.

Other points of interest are the stabling and breeding of riding horses, and the number of farriers and thatchers still in demand. The Wychwood Forest includes some original Royal Forest woodland and is preserved as a national nature reserve. Glove-making is still practised in the cottages, and the wool trade at Charlbury is a reminder of the past prosperity of sheep farming in the area.

General-purpose Buildings on Hill Farms

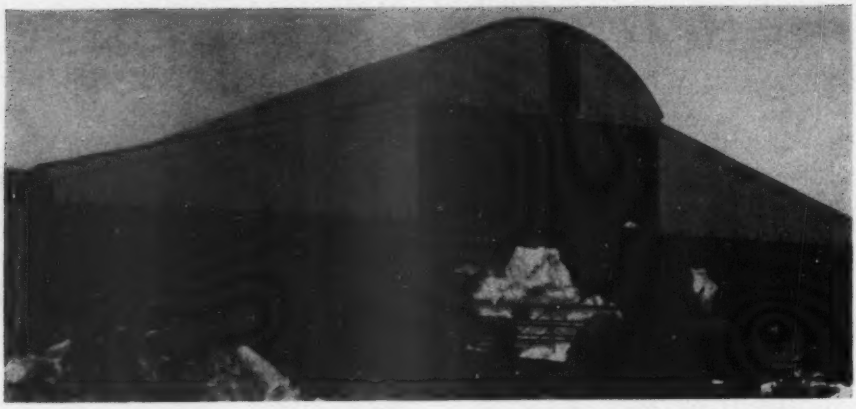
J. R. MATHIAS
Agricultural Land Service, Durham

THE part to be played by agriculture in the National Economic Development Plan can help to solve two of the nation's most urgent problems. It can contribute to import saving and it can help to close the manpower gap by selective expansion combined with increased productivity. Now, what does this mean for the hill farm?

Climatic conditions are limiting factors in hill farming. Control over the elements may be impossible, but protection from them is within our grasp. The umbrella or general-purpose building must be of greater significance on a hill farm than its lowland counterpart.

The use of buildings

After the 1965 hay harvest even the most die-hard traditionalist might question the wisdom of making hay under such conditions. Given the buildings, silage-making would be more popular in hill areas. Once it is made, the easiest way to use silage is either to 'easy feed' or to allow loose-housed stock to self-feed. The nitrogen bag can be put to good use and grassland exploited to the full. Stock-carrying capacity can be stepped up with little extra manual effort.



Mechanization goes hand in hand with increased production, and somewhere to store expensive machinery is essential. Without protection from the weather machinery rapidly deteriorates in condition. Costly depreciation in the usefulness and value of machinery quickly makes itself felt.

Home wintering of hoggs has been gaining ground and with the yarding of lowland ewes, dare it be said, some in-wintering of hill ewes may not be far away. The value of having the flock close at hand and well protected in times of prolonged snowfall has already shown itself this winter. The routine tasks of dipping, clipping and other handling operations should not be forgotten. Sheep gathered dry into a large building can mean a day's clipping in wet weather.

The future

Traditional methods of management are giving way to improved techniques. Amalgamations are taking place and creating units with scattered sets of buildings similar to those illustrated on page 89. To meet modern requirements most hill farmers must be prepared to reorganize their steadings. Seldom has much planning been done in their siting and layout but, like Topsy, they have just grown. When designed a century or so ago they may have met the requirements of the age, but if a hill farmer has an old-fashioned homestead and has never sat down to examine his buildings in detail, then it is about time he did.

As a start, he must have a plan of his buildings, drawn to scale. It is amazing what a task some people may have to find one, or even to draw one up, showing existing facilities. When such a plan has been prepared it will in all probability become clear that the best solution will be a well-sited new building as part of the essential reorganization required in order to achieve increased productivity combined with saving of labour.

It is at this stage that thought should be given to the adaptability of a clear-span general-purpose building which will allow for extension at a later date if required. There is now a wide variety of panel walling units to choose from in several materials, all of which allow flexibility in the use of the building. A Dutch barn adapted for storing silage may have a lean-to attached on either side (see photograph above) which will allow for the efficient management of suckler cows and young stock, for the storage of machinery and as a shelter for sheep given adequate ventilation.

Forward-thinking farmers are already planning for the future—are you?

IN BRIEF

Experimental Husbandry at Sprowston

Field experiments at the Norfolk Agricultural Station, Sprowston, are mainly on cereals and high-value cash crops such as sugar beet, potatoes and peas for quick freezing. The importance of these crops and the running of the Station as a commercial farming enterprise lends the Annual Reports of the Station a special interest. Among cereal experiments those with malting barley are given special emphasis at Sprowston. Thus, the current Report for 1964–65 includes an account of trials with two new winter-hardy varieties, Maris Puma and Maris Otter, to compare the effect on yield of autumn and spring sowing at three levels of nitrogen manuring. Experience shows that the yield advantage of autumn-sown barley over the spring-sown crop seems to depend almost entirely on the amount and incidence of rainfall in the spring and during May and June. When rainfall is adequate spring-sown barley will yield as well as an autumn-sown crop, but if there is a spring drought autumn sowings can give considerably higher yields. A good feature of both Puma and Otter is that they can give a reasonable yield when spring sown, should soil and weather conditions preclude autumn drilling.

In three years of trials comparing the effect of drilling the newer spring barleys, Proctor and Maris Concord, at 4 in. and at 8 in. row widths, to see whether the narrower row width increased the yield, the 4 in. width gave a yield advantage varying from almost 4 to less than 1 per cent, with a mean advantage of 2 per cent in favour of the narrower width. The nitrogen content of the grain tended to be lower at the 4 in. width but, in general, it increased as the level of nitrogen (42, 63 and 84 units per acre) increased.

Typical of the essentially practical treatment given at Sprowston to farmers' difficulties is a trial aimed at finding some means of reducing the spring labour peak in the growing of sugar beet. In this trial beet, which had been drilled at 1½ in. and 3 in. spacing, was singled either at the normal 4-leaf stage or later at about 10-day intervals. It appears that, provided reasonable plant populations (about 30,000 plants per acre) can be obtained, the effect of delayed singling, due to adverse soil and weather conditions or to labour shortage, can be minimized by drilling at 3 inches. The point is made that a farmer could usefully increase the time available for singling by drilling his earliest sowing at 1½ in. and then increasing to a 3 in. spacing for the later sowings, when soil and climatic conditions are better and are likely to continue to favour the crop.

In a section on experiments in progress, the Report discusses the results of trials to test the effect on yield of variation in the population of irregularly-spaced sugar beet plants. In both this and the spacing experiment already mentioned genetic

monogerm seed was used since it is believed that this type of seed will come increasingly into use as a means of reducing the spring labour peak.

In an interesting experiment on the rate of bulking of potatoes, the effect on the yield of ware of burning off the haulm following blight attack was simulated by removing the tops of the plants at ten-day intervals during the normal blight season —late July to early September. Sprouted and unsprouted seed were compared, and the results indicated that the earlier emergence and greater vigour of sprouted seed enabled it to bulk earlier than unsprouted seed and so be less dependent on freedom from blight in ultimately producing optimum yield. With sprouted seed there was a marked increase in weight of the crop at the last lift. The experiment also confirmed the value of keeping the haulm free from blight for as long as the tubers are actively bulking.

Another section of the Report deals with crop variety testing. This embraces new varieties of cereals, maincrop potatoes, sugar beet, vining peas, Brussels sprouts and lucerne, and includes many helpful observations on their performance, and in many cases, their resistance to disease.

The Station has completed two trials in the Ministry's scheme for testing cattle sired by Charolais bulls. These are reported in detail. In both years the Charolais cross showed a clear advantage over the Hereford crosses in liveweight gain, food conversion, killing-out percentage and in conformation as judged by eye. The advantage over pure Friesians in liveweight gain and food conversion was, however, smaller.

A. J. L. LAWRENCE

Report of the Brambell Committee

New legislation to safeguard the welfare of farm animals is recommended in the Report of the Brambell Committee, published in December, 1965. The Committee was set up to examine the conditions in which livestock were kept under systems of intensive husbandry and to advise whether standards ought to be set in the interests of their welfare and if so what they should be.

The Committee lays down principles which it believes should be observed in the interest of animal welfare, applies these principles to intensively-kept animals and concludes that, while the use of intensive methods is not in itself objectionable and may often benefit the animals, certain practices are unacceptable and need to be controlled. It considers that existing legislation does not adequately safeguard these animals and that a new Act is needed incorporating a fuller definition of suffering and empowering Ministers to make regulations as to the housing and other conditions under which poultry, pigs, cattle and calves are kept.

The Committee envisages that inspection of farm premises will be necessary for the enforcement of these standards and recommends that this should be in the hands of the Ministry's Veterinary Service. The Committee considers that the welfare of animals, especially those kept intensively, depends to a great extent on the qualities and skills of the stockman in charge of them. The provision and scale of appropriate training facilities should be reviewed and all possible steps taken to encourage the employment of trained stockmen on intensive units. The Committee also considers that continuing developments in animal husbandry are likely and recommends that a statutory Standing Committee should be set up to keep the position under review and to advise Ministers should changes become necessary.

The Report is at present under consideration by the Minister of Agriculture, Fisheries and Food, and the Secretary of State for Scotland. The Report, entitled *Report of the Technical Committee to Enquire into the Welfare of Animals Kept Under Intensive Livestock Husbandry Systems* (Cmnd. 2836) is published by H.M.S.O., price 6*s.* 6*d.* (by post 7*s.*).

Research on Herbicides

The Agricultural Research Council recently published a supplementary report by its Research Committee on Toxic Chemicals. The main part of the supplementary report is concerned with a review of research being done on herbicides, since these were omitted from the main report. The Research Committee is satisfied that official and industrial organizations are doing much to exploit herbicides efficiently and advise that nothing should be done to reduce the benefits obtained from the use of herbicides or to hinder future achievements. Nevertheless the report recommends that further research is needed on the evaluation of the properties of herbicides; the factors affecting selective phytotoxicity; the development of new methods of crop husbandry arising from the use of herbicides and minimal cultivations; the development of machinery designed specifically for the application of herbicides; and the ecology of weed species and populations. The report is available from H.M.S.O., price 2*s*. (by post 2*s*. 5*d*.).

Progress in Pig A.I.

Two interesting developments concerned with the artificial insemination of pigs have recently been announced. First, The Wall organization announced at the end of last year that it will be introducing a new progeny-testing scheme in 1966 under which semen will be collected from selected boars and will be used to inseminate standard dams in Walls's sow herd at Tring. It is hoped that this new scheme will reduce the disease risk involved in bringing stock to the Tring centre under the existing scheme and will also eliminate much of the variability of the dams used under the previous scheme. All the gilts within the standard sow herd will be fed on an oestrus control regime which will allow Walls to synchronize heat periods of the females with the collection of semen. Walls have been carrying out their own research programme on pig A.I. for some two years and claim that they can get up to 4 days' life on A.I. collection and that, on a test covering 331 gilts, they have been able to get 80 per cent of the gilts holding to first service.

Secondly, the Pig Industry Development Authority has recently announced that a large gilt pig artificial insemination project will take place in the North Riding of Yorkshire and will involve the trial of an experimental compound designed to synchronize heat in gilts. The project is planned to last a year and some 2,100 gilts will be inseminated at the rate of 180 a month. Semen will be provided by seven Large White boars at PIDA's A.I. centre at Thorpe Willoughby, near Selby.

These two developments would appear to give some encouragement to those who hope that one day A.I. will be available generally to commercial pig keepers.

Foot-and-Mouth Disease

There has been a considerable build-up of foot-and-mouth disease on the Continent of Europe during recent months, particularly in Holland, Belgium and Switzerland. Inevitably this increases the risk of the disease spreading to this country, and in consequence farmers should be more careful than ever to be on the look out for any signs of suspicious illness among their stock. Signs to be looked for are, in cattle, excessive salivation, lameness or stiffness, sudden fall in milk yield and sore teats, and in sheep and pigs sudden severe lameness or evidence of 'cramp'. At the first sign of any symptoms which could possibly be foot-and-mouth disease the farmer is advised to consult his veterinary surgeon or report his suspicions to the Ministry's Divisional Veterinary Officer.

Books

Brave New Victuals. ELSPETH HUXLEY. Chatto and Windus, 1965. 21*s*.

In his foreword to this book Peter Scott writes that man has not yet discovered that quality in life is a better aim than quantity. Something will, of course, happen to check man's terrifying fecundity and to falsify the extrapolations of population curves which are so frequently made, but the pressure is on now, with results in farming which we may not all like.

Mrs. Huxley has been very industrious in her inquiry into modern food production. Battery hens, synergism, anaemic calves, paraquat, sex attractants, M.D. pigs, fluoracetamide, to give but a few examples, are all there—the lot. With such a vast field covered in such a short book, it would be querulous to complain that here and there some qualification or amplification is missing and attribute this to any lack in the author's knowledge. She has quite deliberately chosen to sit on the fence, a posture that she maintains with considerable skill. Grim possibilities of harm from chemicals are suggested, but this is accompanied by a statement of the gains that accrue; the tale of organochlorine contents of eggs of predator birds is set alongside the economic and humanitarian benefits of saving sheep from blowfly. One of the most interesting chapters is that on stress. This contains much that will be new to most readers. Like cats with sufficient territory for everyone, we too might sit around and lick each other if it were not for our own appalling prolificacy.

The method is to present both sides of the case and then challenge the reader to make his own decision (the book must hold some sort of record for the number of question marks a page). This is fair enough, but there are sinister implications which build up as the book is read. Confronted with a long succession of unanswerable questions we tend to admit we know nothing. But the greater the circle of knowledge the wider the area of darkness that surrounds it. All these questions are, indeed, evidence of the great progress that has been made. Early work may have been empirical, but year by year deeper inroads are being made into chemical structures, biology of pests, modes of action of pesticides and even into ecological changes. As research goes on yet more questions will arise, for that is in the very nature of scientific inquiry. In regard to battery birds, veal calves and the like, an authoritative committee has recently reported on the humanitarian aspects, whilst efforts to prove that the food they provide for us is nutritionally poor have been singularly unsuccessful. Does it taste so good? Many say not, but taste buds degenerate with age and the fault may lie in us.

Mrs. Huxley has a very light touch and the book is a joy to read. Nothing is overdone and there is no inclination to lay it down till the last page has been turned. Yet the wonder lingers as to what it achieves. It is, and always has been, very dangerous to live at all. Certainly we ought to take all proper precautions—but there is no point in frightening ourselves to death.

H.G.S.

Animal Anthology. Brian Vesey-FitzGerald. George Newnes, 1965. 35*s*.

Anthologies are by their nature personal things, unintentionally revealing more of the compiler himself than he is often aware. The quality which distinguishes Brian Vesey-FitzGerald's book is its overtly autobiographical character and the imprint of his philosophy concerning the relationship of man with wild and domesticated animals. His selection of verse and prose, gathered over a wide field with obvious diligence, has been woven into an attractive pattern of reminiscence and present thinking. Twenty-four pages of animal photographs set off the text to perfection.

It was Bryn Davies, the gamekeeper, who showed him as a boy in North Wales his first badger, 'a simple gentleman in sober grey'; and it was Bryn's brother, Dai, the gardener, who taught him the ways of wild creatures. I was glad to see that John Betjeman's *Diary of a Church Mouse* has been included in this section. Cows, 'God's jolly cafeteria', have not been among the

author's favourites since, as a child of five, he found himself alone in a field with cattle which 'big and black, came crowding round me', recalling Wordsworth's lines:

> The cattle are grazing,
> Their heads never raising;
> There are forty feeding as one.

Readers of the author's many books and articles in THE FIELD will not be surprised to find generous tribute to the horse in this anthology. Sir Alan Herbert's *Derby Day* is called to witness:

> Look at that horse! Must such beauty die
> To let more motor-bicycles rush by?

and Macdonald Hastings' modern observations are cited alongside those of La Rochefoucauld and George Bernard Shaw.

Those pages of the anthology which deal with the hunt and the hunted are likely to be quoted in opposite camps but, emotion aside, the strength and imagery of John Masefield's verse *Reynard the Fox*, quoted at good length, rings in the ear long after it has been read. So, too, does John Davidson's *Runnable Stag*.

The early spell of The Big Top had its sequel when the author joined his first circus at the age of 16. So it is not surprising to find Bertram Mills, Ruth Manning-Sanders and Paul Eipper among the chosen writers.

I could wish to have the space to go on quoting, but it must suffice to say that this is a book which will give a lot of pleasure to a lot of people, and that assuredly will be ample reward for a dedicated countryman like Brian Vesey-FitzGerald.

S.R.O'H.

Nutritional Values in Crops and Plants. WERNER SCHUPHAN. Faber and Faber, 1965. 70*s*.

Quality, that elusive property of foods, is the subject of this book. The first four short chapters deal with those criteria commonly used in present-day quality grading—uniformity of size and shape, colour, freedom from blemishes or adventitious matter, and so forth. As an example of the application of these criteria, Ordinances 23 and 64 of the Economic Commission for Europe Working Party on Standardisation of Perishable Foodstuffs are reproduced as an appendix of some sixty pages.

The major part of the book is devoted to the thesis that there is another dimension to quality, i.e., nutritive value. Chapter V, more than one half of the book, discusses the dependence of the biological value of certain selected crops on heredity and on environment. Cabbage, spinach, carrots and apples are treated exhaustively, reinforced by a wealth of numerical data drawn mainly from the author's own publications. A spirited defence of the apple as a source of vitamin C is supported by a long table of the ascorbic acid content of 134 'cultivars' of apple. The values listed range from 31·8 to 2·3 mg/100g. and, although many of the varieties are not common in this country, the table is probably the most comprehensive available. The use and misuse of pesticides, and of manures and fertilizers, are presented as problems in urgent need of solution, and concern is expressed at the appearance in root crops of residues of pesticides—an adverse factor in the concept of the nutritional aspect of quality. Devices designed to promote or maintain presentational appearances of a crop, such as the restoration of turgidity in wilted greenstuffs, or the treatment of citrus fruit with diphenyl or with waxes, are roundly condemned.

This book should be of equal interest to growers, purveyors, and consumers of fruit and vegetables. Each in turn is given sound precepts on which to formulate a policy which, if carried through, should result in the consumer being able to obtain and eat better-looking, more nutritious, and more correctly cooked foods. The plant breeder is exhorted to have as his goal the stepping up of the intrinsic nutritive value of a crop rather than its gross yield.

It is, however, to those interested in nutrition that the work should make a strong appeal. The presentation of accumulated data, often in tabular or graphical form, on the composition of the raw material, and on the losses it may undergo by storage, transport, processing or cooking, is a mine of information difficult to come by except by laborious searching. On the other hand, the author's presentation of the controversial problem of the increased incidence of heart disease in modern times may not be acceptable to all. The popular misconception that aldrin and dieldrin are banned in this country seems to have been perpetuated (p. 25), but the true position is given later in the book (p. 132).

The translation has been carefully done, a list of some 250 references to the literature is given, and the index is adequate.

W.M.S.

A Bibliography of Farm Buildings Research. Part I: Buildings for Pigs, 2nd Supplement, 1962–64. Agricultural Research Council, 1965. 5*s*. 6*d*. (by post 6*s*.)

There is a commonly-held belief that little is being done in farm buildings research. This admirable bibliography goes a long way to dispute that belief. It brings together summaries of work in various fields of animal research which provide valuable and essential data for planners and users of farm livestock buildings. Only when optimum requirements are known can they be provided, and until they are established no amount of trial-and-error building methods will by themselves provide the answer.

Throughout the world, research and experiment is seeking the answer to pig housing needs. The work continues, but we are a long way from the standard pig building. This is inevitable, for as one horizon is reached another appears as new knowledge opens the door to further possibilities.

What has so far been done has transformed our pig housing in a short space of years. There are indications in this supplement that we shall see still more changes.

The resourcefulness of the bibliographers in their far-ranging search is commendable. The supplement is good value for little money and is recommended to all with an interest in pig housing.

C.R.

Portrait of Northumberland. NANCY RIDLEY. Robert Hale, 1965. 21*s*.

This is the tenth book in the 'Portrait' series. As the author states, it is neither a comprehensive history nor a guide book. A sketchy geographical and scenic framework is heavily filled in with historical facts, anecdotes and legends. Much of this has appeared in previous books on the county, but the wealth of detail and the amount of new material are evidence both of an intimate knowledge and extensive research on the part of the author. Indeed Miss Ridley has delighted many Northumbrian audiences with her talks on similar themes.

The selection and treatment of the material for this kind of book are obviously a reflection of the writer's personal interests. I would, however, like to have seen rather more about the present-day scene, and certainly a fuller and more accurate picture of agriculture, in a portrait of Northumberland which, as the author states, is 'above all a farming county'. References to farming are, in fact, not only scanty but often inaccurate. For example, the whole of the county's grassland (other than rough grazings) is described as rich grazing land. It is stated that 'approximately one and a half million sheep, largely the indigenous Cheviots and Blackfaces, graze on Northumberland's uplands'. The facts are that, of the county sheep population of just over one million, some 70 per cent are Half-breds and their Down-cross lambs which graze lowland pastures, and that Cheviots are outnumbered by Swaledales, a breed not mentioned. Hill shepherds will be surprised to read that they 'either ride on horse-back or travel by Land Rover to tend their flocks'.

With such a wealth of scenic material available, it is a disappointment to find that most of the twenty-four photographs are duplicates of illustrations in H. L. Honeyman's book *Northumberland* published in 'The County Books' series in 1949.

The rather too liberal use of superlatives is something which a fellow-Northumbrian can more readily forgive!

J.R.J.

Eley Game Advisory Station Annual Report, 1964-65

The success of the Country Landowners' Association's Annual Game Fair, held recently near Oxford, shows how widespread is the interest in all country sports. Although every stretch of water seems to have its angler, probably shooting is the next most popular activity. Whether taking part in an organized shoot or on one's own walking-up game on a rough shoot, the individual can spend many happy hours out of doors. To be a good shot takes practice, care, knowledge of wild life and an eye for country. When the day is over, the shooting enthusiast can settle in his armchair with plenty of magazines and other publications about his favourite sport. Here is one he will enjoy.

This well-produced and attractively-presented report contains 80 pages of information about the activities of an Advisory Station much respected by those interested in game preservation and shooting.

After reviewing the present game situation, it describes the experimental field work undertaken mainly at Fordingbridge in Hampshire and also elsewhere throughout England and Scotland, often in co-operation with landowners and farmers. Evidence of increasing interest in improving game conservation is that during the year advisory visits were paid to new estates totalling 340,000 acres and there has been an increase in inquiries to over 4,600. Important contents are the Game Census of 1964–65, articles on incubation and rearing during 1964, a review of the farming scene in Scotland, and a particularly interesting section on aquatic food and cover plants. Some short notes include reports on gamekeepers' training courses and breeding partridges on wire floors. These and other fascinating notes contain a wealth of information. There is even an illustrated article on the basic layout of a game spinney.

Putting a match to unwanted straw may be an easy way to get rid of it but, in addition to the danger to other crops, hedges and trees, great harm can be done to game. The Report gives a valuable warning on the danger of straw burning getting out of hand.

The impression left by the Report is that much more could be done by judicious management to encourage game conservation in many parts of the British Isles. The present keen demand for shooting should encourage many landowners and farmers to develop this source of income.

Copies are free from the Eley Game Advisory Service, Fordingbridge, Hampshire.

R.G.A.L.

Rural Studies. F. J. BOLGER. Allman, 1965. 35*s*.

The subject of rural studies—to give it the contemporary and proper description—or rural science, is widely taught in secondary modern schools in this country. Although its place in the work of country schools is obvious, it is an interesting fact that it should prove popular, and educationally useful, in town and suburban schools.

The place of some subjects in the school curriculum is well defined. Their aims and objects are known and lead to some obvious goal, which may be a system of examinations, a specific ability or a skill. Rural studies demands a broader approach, being a complex of studies which embraces a number of specific topics, all more or less closely related.

It is for this reason that good teaching of rural studies demands a sound appreciation by its teachers and well-set-out schemes of work. It is in planning the work that Mr. Bolger's book will prove its worth.

The book is in two main parts. The first part, about one-third of the contents, deals with the general principles of rural studies, and contains a good deal of fundamental thought about the subject to be taught. The guidance offered in these ten chapters is soundly thought out, and is based on experience and observation. A monthly programme of work is included.

The larger part of the book gets to grips with the practical details of teaching and presentation. The seventeen chapters are packed with ideas, outlines of work, suggestions for school work and further studies, and lists of other books which should be consulted by the teacher and the children he is teaching.

Agriculture and horticulture form a subdivision only of this part, which ranges over a very useful variety of topics. The technical man may find a few points to query in a work which provides as brief a glimpse as this of some specialist topics; I noted some wrong emphasis in the sections on breeds of livestock, for example. But this is of little importance where the main lines of investigational work are left for the teacher to follow and where the bias is towards general education rather than technical instruction.

This is a useful book for the teacher. The general message is sound and eye-opening; the approach is positive and full of enthusiasm. The presentation is clear, and the bias is to the practical and the realistic.

G.B.

Books Received

Forestry Commission Report on Forest Research for the year ended March, 1964. H.M.S.O., 1965. 20*s*. (by post 21*s*. 3*d*.).

Dairyfarming Annual, 1965. Massey University of Manawatu, New Zealand. 12*s*. 6*d*.

Farmer and Stockbreeder Year Book and Desk Diary 1966. 25*s*.

The Economic Position of Sheep in The Eastern Counties. A report on a survey covering the years 1961 to 1964. B. J. Jackson. Farm Economics Branch, School of Agriculture, Cambridge. 2*s*. 6*d*. (including postage.).

Animal Breeding Research Organisation Report—January 1966. Agricultural Research Council. H.M.S.O. 6*s*. 6*d*. (by post 7*s*. 1*d*.).

The Nutrient Requirements of Farm Livestock. No. 2. Ruminants—Summaries of Estimated Requirements. Agricultural Research Council. H.M.S.O. 5*s*. (by post 5*s*. 6*d*.).

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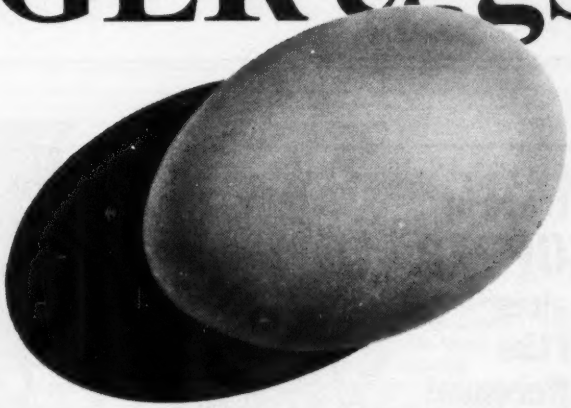

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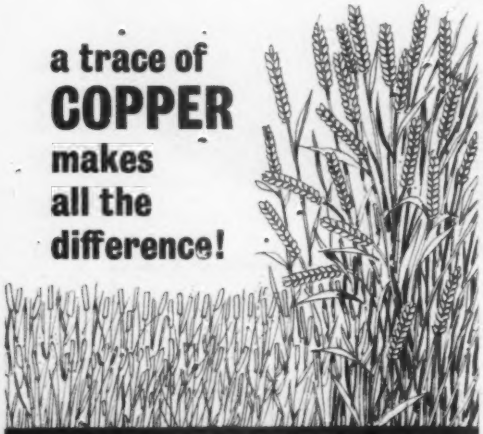

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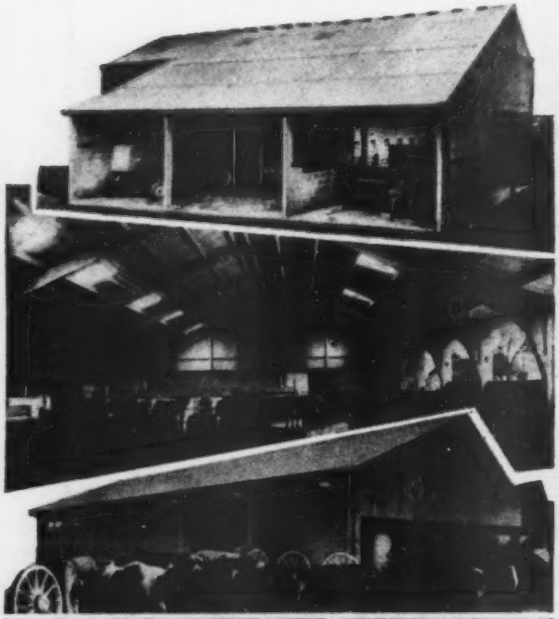

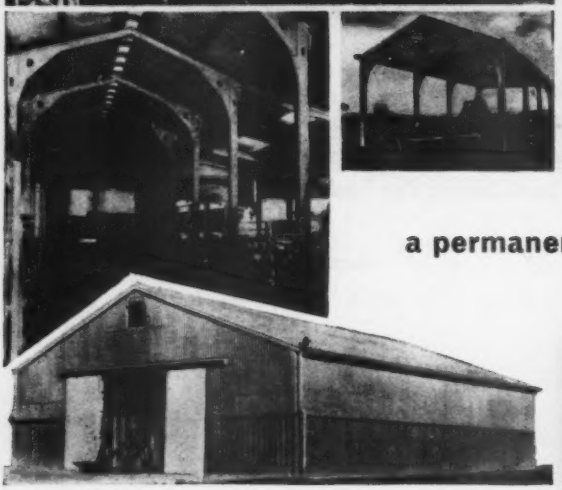

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